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CONTENTS OF VOLUME VI.

PAGE
List of Members ... 1
Nesting in Western India. (*Continued*) (*with a Plate.*) By Lieut. H. E. Barnes, F.Z.S. ... 1
Notes on a Collection of Butterflies made in the Chin Lushai Expedition of 1889-90. By E. Y. Watson ... 26
The Genus *Chloropsis*, By E. C. S. Baker... ... 59
A List of the Odoriferous Grasses of India, with a description of a New Species of *Andropogon*. By Mrs. J. C. Lisboa ... 64
Curious Instance of Abnormal Infloroscence of *Cæsalpinia* (*Poinciana*) *pulcherrima* (*with a Plate*) ... 71
Landscape Gardening in Native States. By G. Carstensen, Superintendent, Victoria Gardens, Bombay ... 72
List of Birds' Eggs in the Society's Collection on 1st January, 1891 ... 83
The Preservation of Insectivorous Birds, Birds of Plumage, and Game in the Central Provinces ... 87

Reviews of New Books—

"The Reptilia and Batrachia of India" ... 100
"Hume's Indian Oology" ... 104

Miscellaneous Notes—

1.—Concerning the presence of the *Taraxacum officinale* in the Nilgherries ... 106
2.—A Variety of *Butea frondosa* ... 107
3.—Harpooning Crocodiles ... 107
4.—A Man-eating Panther ... 108
5.—The Cultivation of Oranges, Lemons, and Figs in India ... 111
6.—Distribution of Indian Crocodiles ... 116
7.—Victoria Crown Pigeons breeding in Confinement ... 117
8.—Indian Otters ... 117
9.—Our *Hymenoptera* ... 118
Proceedings ... 118
The Proposed Introduction of Game into the neighbourhood of Bombay ... 119
Pithecolobium unguis ... 124
Nesting in Western India. (*Continued.*) By Lieut. H. E. Barnes, F.Z.S. (*with a Plate.*) ... 129
Bombay Ferneries. By G. H. Carstensen, Superintendent, Municipal Gardens ... 153
The Butterflies of the Central Provinces. Part IV. By J. A. B. ... 175
On Abnormal Horns of the Indian Antelope, with some Remarks on their Probable Causes, (*with a Plate*). By A. W. Morris, F.Z.S. ... 184
Bombay Grasses. (Part IV.) By Dr. J. C. Lisboa, F.L.S. ... 189
Notes on a rare Fungus found growing on the Drumstick Tree. By Surgeon-Major K. R. Kirtikar, I.M.D. (*with a Plate.*) ... 219
On the Gaur (*Bos gaurus*) and its Allies. By W. T. Blanford, F.R.S., F.Z.S. ... 222
Agricultural Entomology. By E. C. Cotes ... 230
The Locust of North-Western India. By E. C. Cotes, (*with a Plate*) ... 242

Miscellaneous Notes—

1.—Shingle and Shells from the Beach at Umbargaum ... 262
2.—Leaf Weevils ... 263
3.—The Temerity of Rats ... 264
4.—*Dalbergia spinosa* ... 264
5.—The Destruction of Life by Wolves in the Hoshangabad and Narsinghpur Districts ... 265
6.—The Migrations of Birds ... 268
7.—*Alocasia macrorhiza* ... 270
8.—Doum Palms in India ... 271

52079

9.—A Gall on *Tamarix dioica* 273
10.—A Variety of *Butea frondosa* 273
11.—A Panther Eating a Panther 274
12.—A Man-killing Bear 276
13.—Price of Tigers' Skins in England, &c. 278
Proceedings 278
The Protection of Wild Birds and Animals 281
Statements of Accounts from 1st January, 1890, to 31st December, 1890 283
Nesting in Western India. (*Continued.*) By Lieut. H. E. Barnes, F.Z.S., (*with a Plate.*) 285
The Butterflies of the Central Provinces. Part V. By J. A. B. 318
Notes on Nidification in Kanara. By J. Davidson, Bo. C.S. 331
On New and Little-Known Butterflies from the Indo-Malayan Region. By Lionel de Nicéville, F.E.S., C.M.Z.S., &c., (*with Plates F. and G.*) 341
Substances used as Incense in the East. By W. Dymock, Brigade-Surgeon, Retired 399
Protective Mimicry. By Mrs. W. E. Hart 410

Miscellaneous Notes—

1.—The Natural Enemies of the Locust 416
2.—Taming a Heron 417
3.—Snipe Shooting in the Neighbourhood of Secunderabad 418
4.—Memory *Versus* Reason in Cats 419
5.—The Breeding of Snakes 420
6.—How the Monitor or Ghorapad (*Varanus bengalensis*) defends itself 421
7.—Bombay Ferneries 421
8.—A Fasting Snake 424
9.—The Sagacity of the Langoor 424
Proceedings 425
Description of a New Species of Palm-Civet (*Paradoxurus*) Found in Orissa. By James Taylor (*with a Plate*) 429
A List of the Butterflies of Travancore. By H. S. Ferguson, F.L.S. 432
Description of a New Species of Lizard obtained by Mr. H. S. Ferguson in Travancore, Southern India. By G. A. Boulenger 449
Description of a New Species of Frog obtained by Mr. H. S. Ferguson in Travancore, Southern India. By G. A. Boulenger 450
On the Value of the Plant Pangala (*Pogostemon parviflorus*) in Cases of Bites by the Phursa Snake (*Echis carinata*). By Brigade-Surgeon W. Dymock, Retired 450
Notes of the Mammalia of Somali Land. By J. D. Inverarity, (*with six Plates*) 457
Landscape Gardening in Native States. By H. St. John Jackson 478

Miscellaneous Notes—

1.—Note on *Cassia grandis*, Linn. and *C. marginata*, Roxb. 485
2.—Branching Palms and Tree-Ferns 486
3.—The Protection of Game in Sind 487
4.—Geographical Distribution of the Pin-Tail Snipe 488
5.—Protection of Larvæ 489
6.—A new Method of Preserving and Mounting Zoological Specimens 489
7.—The Poison of the Toad 494
8.—Tigers in Sumatra 496
9.—"Has the Bakri a Keen Sense of Smell?" 497
10.—The Temper of Animals 498
11.—The Crested Grebe breeding in India 501
Proceedings 501
List of Books in the Society's Library 504

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Messent, P. G.	...Bombay.
Metha, P. R.	...Khandeish.
Myer,e O.	...Bombay.
Middleton, T. H.	...Baroda.
Middleton, W. H.	...Poona.
Millard, W. S.	...Bombay.
Miller, E.	...Bombay.
Miller N.	...Giridhi.
Millett, G. P.	...Thana.
Minter Capt. J. S.	...Karachi.
Modi, Bomanji Edulji	...Broach.
Monie, H.	...*Europe.*
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Monks, Dr.	...Aden.
Monod, E. C.	...Bombay.
Monté, Rev. Dr. B de	...Bombay.
Monté, Dr. D. A. de	...Bandora.
Morris, A. W· (F.Z.S.)	...Yercaud.
Morris, D.	...Bombay.
Morrison, A.	...*Europe.*
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Mull, Alfred	...Sholapore.
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Murray, W.	...Bombay.

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NazarM. H.	...Bombay.
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Newnham, Lieut. A.	...Simla.
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Nicholson, C.	...Bhosawal.
Nicholson, E. F.	...Bombay.
Nutt, Col. H. L.	...Mahikantha.

Oates, E. W. (*Hon. Cor. Member*)	...Tonghoo, Burma.
O'Callaghan, I.	...*Europe.*
O'Connel, J.	...Bombay.
Oliver, G.	...Calcutta.
Olivier, Capt. H. D.	...*Europe.*
Ollivant, E. C. K. (C.S.)	...*Europe.*

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Pinhey, Lieut. A. F.	Bhuswara.
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Preston, F. J.	Bhosawal.
Prickett, L. G.	Sambulpore.
Raikes, E. B.	Bombay.
Radcliffe, Major G. B. E.	Bombay.

Radcliffe, Capt. W. C. A.	*Europe.*
Raghunath Muckund	Bombay.
Raja Murli Manohar, Bahadoor	Hyderabad, D.
Rawlins, Col. A. M. (R.A.)	Poona.
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Sims, Proctor	Bhownuggur.
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Sinclair, W. F. (C.S.)	Thana.
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Stewart, R. B. (C.S.)	Ahmednuggur.
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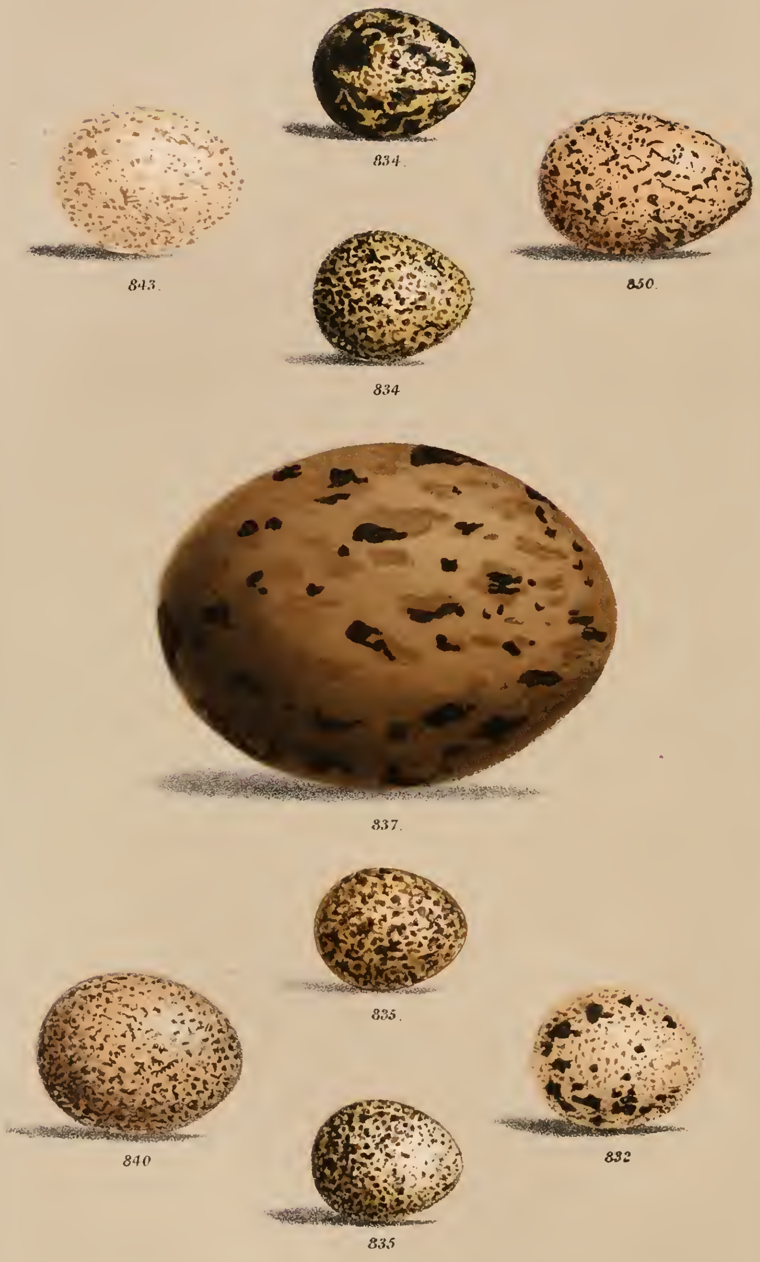

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832. TURNIX TAIGOOR, Sykes. Black-breasted Bustard Quail 834. TURNIX JOUDERA, Hodgs, Large Button Quail.
835. TURNIX DUSSUMIERI, Tem. Small Button Quail. 837. HOUBARA MACQUEENI, J.E. Gr. Houbara Bustard.
840 CURSORIUS COROMANDELICUS, Gm. Indian Courier Plover. 843. GLAREOLA LACTEA, Tem. Small Swallow Plover.
850 ÆGIALITIS MINUTUS, Pall. Lesser Ringed Plover.

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NESTING IN WESTERN INDIA.

By Lieut. H. E. Barnes, F. Z. S.

(*Continued from page* 337, *Vol. V.*)

803.—THE PEACOCK.

Pavo cristatus, Lin.

The Peacock is not indigenous in Sind, but has been introduced, and in some parts of the country appears to thrive tolerably well, and is in a fair way to become naturalized. It is somewhat rare in Ratnagiri, but occurs not uncommonly in all other suitable places in Western India.

In Guzerat, and some other parts of the country where the birds are considered sacred, and are in consequence protected and encouraged by the villagers, they are very tame, roosting at night in the topes in the neighbourhood, or even inside the village boundaries, where there are high trees.

In those districts where, in the estimation of the people they are not sacred, they are extremely wary and shy, and are most difficult to bag. They occur as a rule in great numbers in the groves in the neighbourhood of the temples, and are generally abundant along the wooded banks of rivers, ravines, and on the hillsides where the undergrowth is rank.

They are much persecuted by shikaries, Phansi Pardis, and others, for the sake of the beautiful tail—or rather I should say train—which they commence to assume early in May, and which attains its greatest perfection about the middle of June; these trains, as well as the back and breast, always command a ready sale in cantonments.

The day when this handsome bird will become extinct cannot be far distant, unless some stop is put to the enormous traffic in their plumes which is now carried on. I notice in the last number of the *Field*, June 21st, 1890, that Cross in that week alone imported no less than 70,000 bundles of their feathers.

The eggs are laid during July and August, and are from six to eight in number, occasionally more; they are generally found on the ground, in the centre of a bush, in long grass.

They are delicious eating when fresh, and always fetch a good price; they are often purchased and placed under a hen; the chicks when hatched are easily reared if left to themselves, more especially if they get a plentiful supply of their natural food, particularly white ants.

The eggs are very game-like in appearance, having a great resemblance to those of the common guinea-fowl, but are of course much larger; the usual shape is a broad oval, more or less pointed at one end, but they vary a good deal, the average size being two and three-quarter inches in length by a little more than two in breadth. The shell is very strong and thick, is somewhat glossy, and is covered all over with minute pores; in colour they vary from white to pale reddish- or buffy-white, occasionally they are freckled with pale reddish-brown.

813.—THE GREY JUNGLE FOWL.

Gallus sonnerati, Tem.

The Grey Jungle Fowl is most abundant at Aboo, occurring all along the Aravelli range as far as and beyond Erinpoora. It occurs more or less commonly on the Satpooras, and all along the Sahyadri range, but it is somewhat rare in Ratnagiri At Belgaum it is fairly common.

The skins are eagerly bought up by visitors to the hills, and were it not for the impenetrable nature of the bamboo jungle, which forms such splendid coverts for them, they would soon become practically extinct, as it is, its queer broken crow is not heard so frequently as formerly. They are very wary and shy, and unless with the assistance of dogs or beaters, they are very difficult to shoot. The native plan is to make a bower, near a spring, and wait patiently until the birds come to drink; should there be more than one spring in the neighbourhood, they hang pieces of cloth on the bushes to frighten them back. In this way they shoot two or three in a morning, besides an occasional peacock or spurfowl and a few partridges.

They breed from March to about the middle of June, the eggs, six or seven in number, occasionally more, are deposited on the ground, under a bush, in a slight depression, scratched by the bird itself, lined with a few dead leaves; the hen bird when leaving the nest usually covers her eggs with leaves, and they are often overlooked in consequence.

The eggs vary a good deal in size, shape, and colour; they average 1·84 inches in length by rather more than 1·38 in breadth; one type is a long smooth egg, of a pale creamy-white colour, much like that of the common hen; another is much coarser, being pitted all over like that of the Peafowl, of a rich deep buffy colour: these types are linked together by intermediate forms; some of them are thickly speckled with brownish-red.

The young if hatched out under a fowl, make their escape as soon as they can fly, and they learn to fly very soon.

I once shot a hybrid bird between this and the common fowl.

Mt. Aboo, March to June. *H. E. Barnes.*

811.—THE RED SPUR FOWL.

Galloperdix spadiceus, Gm.

The Red Spur Fowl occurs in much the same localities as the Grey Jungle Fowl; it is however much more common. It is a permanent resident wherever found, breeding during the hot season, that is, from the end of February to the commencement of June.

The eggs, from five to eight in number, seldom more, are laid in a hollow, scratched for the purpose, generally in a dense thicket of undergrowth or almost impenetrable bamboo clump; the nest is merely a few bamboo leaves and grass.

The eggs vary in shape, but are typically the same as those of the common hen, measuring 1·65 inches in length by rather more than 1·2 in breadth; in colour they range from pinkish-buff to creamy-white.

They are quite as wild as the Grey Jungle Fowl, but often, when waiting for a shot at a Sambur, by remaining perfectly quiet, I have seen them scratching and pecking within a couple of yards, vanishing the moment I made the least movement.

Mt. Aboo, March to May.	*H. E. Barnes.*
Baroli, near Neemuch, April.	*Do.*

815.—THE PAINTED SPUR FOWL.

Galloperdix lunulatus, Valenc.

The Painted Spur Fowl is very rare, an odd specimen or so has been procured near Belgaum, and I myself possess the skin of a bird shot in the neighbourhood of Neemuch.

These are, I believe, the only recorded instances of its occurrence in Western India.

The birds are not given to wandering, and as a rule breed wherever found, but the only eggs I have, I took at Saugor, Central Provinces, where the bird is the common spur fowl of the country.

They breed in much the same way as the Red Spur Fowl, and their eggs are identical.

818.—THE BLACK PARTRIDGE.

Francolinus vulgaris, Steph.

Within our limits this fine game bird is practically confined to the province of Sind, and the more northerly portion of the Runn of Cutch.

In Upper Sind it is particularly common, becoming less abundant towards the south, and only occurs as a rare straggler south of the Runn of Cutch.

They breed about June and July, making a nest of grass and roots, usually in tamarisk jungle; sometimes under a bush in a more open spot, this latter but rarely, I have only found one such in three years. I have never found more than five eggs in a nest, but they were always fresh, and the shikaris speak of finding as many as ten or twelve.

The eggs are peg-top shape (sphero-conoidal), and measure 1·55 inches in length by nearly 1·31 in breadth.

They vary in colour from a greenish-fawn to a darkish stone or drab; they are usually somewhat glossy.

The birds are very fond of tamarisk jungle.

Hyderabad, Sind, June and July. *H. E. Barnes.*

819.—THE PAINTED PARTRIDGE.

Francolinus pictus, Jard. and Sel.

I do not think that the Painted Partridge is found further north than Kathiawar. I found them abundant on the plains at the foot of Mount Aboo, and in the vicinity of Deesa and Ahmedabad.

They occur also at Poona and Belgaum, but appear to be absent from Ratnagiri and Kanara. I once shot a bird at Karli, on the plateau just below the Caves.

Roughly speaking, the birds are absent from the north and south of Western India, but are common in suitable places elsewhere; they do not frequent the hills or forest-clad districts.

The eggs are laid in a depression on the ground, loosely lined with grass and roots, generally under the shelter of a tussock of coarse grass or small bush. I have never taken more than seven eggs in a nest, and have often found five fully incubated.

The eggs resemble those of the Black Partridge in shape, but are much smaller, measuring 1·4 inches in length by 1·15 in breadth. In colour they vary from faint greenish-white to stone colour.

They have scarcely any gloss, and what little there is disappears if the eggs are at all incubated.

They breed during the rains from the latter end of June to the middle of August.

Neemuch, June to August. *H. E. Barnes.*
Deesa, June and July. *Do.*

820.—THE CHUKOR.

Caccabis chukor, Gray.

The Chukor occurs on the hills that divide Sind from Khelat; it is very common all along the Bolan Pass.

I have personally only met with it in the latter place, and on the Khoja Amran Hills in South Afghanistan, where it is particularly common, and from whence I procured a splendid series of eggs, during the latter part of April and all through May, during the war in 1880. I never noticed what might fairly be called a nest; the eggs were placed on the ground in a hollow, under the shelter of a bush, with perhaps a few straws that appeared to have come there by accident, rather than with any intention to form a nest.

Eight is the largest number that I ever found in a nest, but the Afghans, some of whom are intelligent and close observers of nature, assert that they often find fifteen or twenty.

I once saw a hen bird with quite the latter number of chicks, but that they all belonged to the same brood I am not prepared to say.

The eggs are somewhat peg-top shape, but not to such an extent as those of the Francolins. They average 1·36 inches in length by about 1·1 in breadth. In colour they are pale stone, darker or lighter in different specimens, speckled and blotched with lavender-brown.

821.—THE SEESEE.

Ammoperdix bonhami, Gray.

The Seesee Partridge frequents the same localities as the last, but it is only in the Bolan and Khojak Passes that I have met with them. They breed from the end of April to the commencement of June. The nest, if it may be called such, is a few scraps of grass and roots, lining a slight depression on the ground in a similar manner to that of the Chukor. I have never taken more than six eggs in a nest, but I understand that they often lay ten or twelve. The eggs resemble a common type of those of the Grey Partridge, pale smoky-white, at times inclining to fawn.

They are absolutely unspotted; they measure 1·36 inches in length by about 1·1 in breadth.

822.—THE COMMON GREY PARTRIDGE.

Ortygornis pondiceriana, Gm.

With the exception of Ratnagiri, the Grey Partridge is common throughout Western India, but occurs more sparingly on the hills. They commence breeding about the end of February, and eggs may be found up to the end of April. I am inclined to think that they have a second brood in the autumn (August), as I have repeatedly seen young birds at that season, though not so often as in the spring months, and they may have been the produce of birds that had lost their first eggs through an accident.

The nest, composed of grass and roots, is a more or less compact pad, placed in a depression on the soil, under cover of a clod of earth, tussock of grass, or small bush; occasionally there is no nest.

I found one nest at Deesa in the side of a grass stack; it was quite three feet from the ground, and although there was not the slightest necessity for it, consisted of a substantial pad of grass, the materials of which had been collected from the stack itself; this nest contained three fresh eggs only, but the bird would have laid more, and perhaps did, as I molested neither her or her nest.

The eggs, from six to nine in number, are slightly elongated ovals, pinched in more or less at one end, measuring about 1·3 inches in length by not quite an inch in breadth. In colour they vary from almost pure white to deep smoky or brownish-white. I have a clutch taken at Saugor, that are well spotted with clayey brown.

826.—THE JUNGLE BUSH QUAIL.

Perdicula asiatica, Lath.

Occurs I believe on all the hills of Western India, with the exception of those in Sind. It is very common on Mount Aboo, and I found it breeding at Gungrar in Rajpootana; the bird is easily distinguished from the Rock Bush Quail by its much brighter colours. The nest was a rough pad of grass, and was placed under a thick bush, and contained five fresh eggs, white like those of the Rock Bush Quail usually are, and slightly smaller, but it is impossible to generalize from a single clutch.

The eggs measured 0·98 inches in length by 0·8 in breadth.

Gungrar, Rajpootana, September. *H. E. Barnes.*

827.—THE ROCK BUSH QUAIL.

Perdicula argoondah, Sykes.

The Rock Bush Quail is rare in Sind, and I believe altogether absent from Ratnagiri and Kanara.

In all other parts of the Presidency, where the Jungle Bush Quail is absent, this birds abounds. I do not think that the two species are ever found together.

The Jungle Bush Quail frequents the hills, especially when there is low scrub jungle, and the Rock Bush Quail is addicted to the plains. They breed from August to February, but September and October are the months in which most eggs are to be found. The nest is a very slight circular pad of grass, placed in a hollow under the shelter of a tuft of coarse grass or clod of earth. The eggs, from five to seven in number, are moderately broad ovals in shape, pinched in at one end, and measure about an inch in length by about 0·82 in breadth.

They are unspotted smoky-white in colour, occasionally almost pure white. They are exact miniatures of those of the Common Grey Partridge.

828.—THE PAINTED BUSH QUAIL.

Microperdix erythrorhynchus, Sykes.

I have never met with the Painted Bush Quail, but believe it occurs all along the Sahyadri range, and in some parts of the Deccan. The eggs in my collection came from Southern India, and do not differ except in size from those of the Rock Bush Quail; they are a great deal larger, measuring 1·2 inches in length by rather more than 0·9 in breadth.

830.—THE BLACK-BREASTED QUAIL.

Coturnix coromandelica, Gm.

The Black-breasted or Rain Quail occurs more or less commonly throughout the district, but is less common in forest clad or hilly districts.

It appears to be a mere straggler in Ratnagiri, and in many places it is only found in the rains, and I think it is always much commoner everywhere at that time. Many no doubt are permanent residents, but a large percentage come to breed only.

They breed from the latter end of August up to the commencement of October, and occasionally later. I have always found the nests in standing crops, usually through the aid of reapers, who, for the sake of a few pice, will readily point out any nest they find.

The eggs are deposited in slight hollows in the ground, with but the faintest apology for a lining. The eggs, from five to nine in number (I once found eleven), are usually broadish ovals in shape, pinched in at one end, measuring 1·1 inch in length by 0·84 in breadth.

In colour they vary from smoky to yellowish-white or even stone-colour, speckled, spotted, blotched, and clouded with sienna and blackish-brown.

They are subject to much variation, but as a rule the eggs of one clutch seem to be all of the one type.

Deesa, July to October. *H. E. Barnes.*

832.—THE BLACK-BREASTED BUSTARD QUAIL.

Turnix taigoor, Sykes.

I do not think that the Black-breasted Bustard Quail is very common anywhere; I have never met with it on the hills, and it appears to be rare in Ratnagiri. It is not uncommon at Deesa, and I shot it at Mhow and Neemuch. It is more common perhaps in the Deccan. In Sind I have never met with it.

They breed during the rains; the eggs, four in number, are placed in a hollow, generally scratched by the birds themselves, at the base of a clump of sarpat or other coarse grass, which it lines scantily with a few grass blades; the eggs are peg-top shape, measuring 0·93 inches in length by about 0·79 in breadth. They are greyish-white in colour, thickly speckled and freckled with reddish and yellowish-brown, with here and there a black spot.

Deesa, August and September. *H. E. Barnes.*

834.—THE LARGE BUTTON QUAIL.

Turnix taigoor, Sykes.

I do not think that the Large Button Quail is common anywhere in Western India, with the exception perhaps of northern Guzerat and some parts of Rajputana: it has been recorded from most parts of the districts, but it is rare in many of them, more especially in the southern portion of the Presidency.

It does not appear to ascend the hills to any height. During the hot season a single bird may now and then be met with, but towards the beginning and the middle of the rains they appear to become much more common.

Even in the rains they appear to be very locally distributed. In one coorun near Neemuch, I put up seven or eight pairs and found three nests; the next coorun, although exactly similar, did not contain a single bird; and although I was searching particularly for them, I did not meet any other until I had traversed several miles. The following year I found them again in the same fields, notwithstanding that it had been cultivated in part with jowari and bajri.

They breed from about the middle of the rains quite up to the end of September; the nest is usually placed at the foot of a small bush or tussock of grass, in thin grass jungle, and is composed of soft blades of grass and fine roots. The eggs, four in number, are very broad and round at one end, and much pointed at the other (pegtop-shape, without the spike, exactly describes them); they are glossy, and some of them are very handsome.

The ground-colour is usually dirty yellowish-white, densely speckled, spotted, and blotched with brownish-black and pale dingy yellow, with an occasional spot or blotch of inky-purple: in some eggs, the inky purple blotches almost cover the large end, forming an irregular cap, but in most cases it is confined to spots and specks.

The eggs in my collection, taken at Deesa, Neemuch, and Saugor, Central India, average 0·88 inches in length by nearly 0·7 in breadth.

Deesa, 20th July to 19th September. *H. E. Barnes.*
Neemuch, 18th August to 20th September. *Do.*

835.—THE SMALL BUTTON QUAIL.

Turnix dussumieri, Tem.

The Small Button Quail occurs in much the same places as the last; it is however often overlooked on account of its small size and skulking habits.

It frequents open tracts of country, thin grass jungle, and suchlike places, avoiding the hills and forest-clad districts. It is, I think, more or less a permanent resident, but appears to be more common during the rains, at which season it breeds.

Mr. Davidson found many nests in the Khandeish district. The birds are very common during the rains at Deesa, but the only place where I have taken eggs, in that district, was on the Commissariat Bhir or Coorun (Worlee Farm) scarcely a mile from cantonments, but I have often caught young birds both there and at Neemuch; they are easily reared, and become quite tame and fearless. Those I had were quite at home in a large aviary, and did not molest the other birds.

The nest is small, cup-shaped, composed of grass stems and roots, lined with a few hairs, and is placed in a depression on the ground, generally in a hoof print. The eggs, four in number, are much like those of the preceding, but are smaller, and I have not noticed any showing that tendency to form a confluent cap of inky-purple, as is occasionally the case with the others. The eggs I have, most of them received from Mr. Davidson, measure 0·8 inches in length by 0·65 in breadth.

Neemuch, 20th July (nestlings). *H. E. Barnes.*

Deesa, June and July. *Do.*

836.—THE INDIAN BUSTARD.

Eupodotis edwardsi, J. E. Gr.

The Indian Bustard is rare in Upper Sind, but is not uncommon in the lower portion of the Province, more especially in the Thur and Parkur districts. It is not uncommon in the Runn of Cutch, and is said to be abundant in Kattiawar. Mr. Davidson procured it in Khandeish. It is not uncommon in many parts of the Deccan, and is plentiful in Rajpootana and some parts of Guzerat.

It is a bird of the bare open or undulating plains and grass jungle, eschewing marshy and forest tracts, and never ascending the hills to any height; as might have been expected, it does not occur in Ratnagiri or Kanara.

These birds appear to be very regular in their habits, frequenting the same spots at about the same hour, for days together, if unmolested, for feeding purposes. They are very fond of large grasshoppers and locusts. They are not migratory in the true sense of the word, but wander a good deal in search of food; at one season of the year they are common in one part of the country, moving to another as the breeding season approaches. I think most eggs are found in July and August, but occasionally they are met with as early as March and as late as September.

The egg, there is only one, is placed on the ground, at the base of a tussock of grass or stunted bush, generally in a small depression. The eggs vary much in shape, size, and colour. They are all more or less oval; some are moderately broad ovals, pointed at one end; others are longish ovals, similar at both ends; others again are long and cylindrical.

They vary from 2·75 to 3·42 inches in length and in breadth from 2 to 2·45.

The shells are thick and strong, and very commonly exhibit pimples at the large end; in colour they vary from a sort of drab (the usual type) to dingy olive-green. Earthy-, olive-, and pale reddish-brown, and more rarely pale leaden-blue all occur. The markings also vary in like manner, both in extent and in intensity; blotches, clouds, and streaks of a deep reddish-brown, occasionally clearly defined, but more often so faint as to be mere mottlings, are the usual characters; not uncommonly the markings form an irregular cap at the large end, and occasionally they are altogether wanting; some eggs are brilliantly glossy, while others are dull and have little or no gloss.

Personally, I have only taken one egg, this was near Neemuch, but I have received them from Sholapur, and am indebted to Mrs. Pearson of Jhinjhinwara for a good series taken in the Runn of Cutch.

Neemuch, July. *H. E. Barnes.*

Runn of Cutch, July and August. *Mrs. Pearson.*

837.—THE HOUBARA BUSTARD.

Houbara macqueeni, J. E. Gr.

During the cold weather the Houbara is common in Sind and Cutch; it occurs but is rare in the country around Deesa. I shot one on the plains near Mount Aboo, and another quite close to Deesa.

Captain (now Colonel) Butler shot a pair between Ahmedabad and Deesa.

I feel sure that a few at least remain to breed, both in Sind and Cutch ; a friend of mine avers that he has seen eggs in the latter place, but as he did not preserve them, he may have made a mistake, but he is too good a sportsman not to know a Houbara when he sees one.

Mr. Doig had excellent reasons for believing that the Houbara bred in the desert between Godra and Renahoe.

Colonel Butler long ago placed on record, that a perfect egg had been extracted from the oviduct of a female, at the island of Hanjam off the Mekran Coast, in the month of April, and that one or two pairs were breeding there.

Mr. Cumming had eggs brought to him at Fao in Persia, said to belong to the Houbara ; I examined five of these eggs, and also four others that had been sent to Major Babington Peile from somewhere in Persia.

They were intermediate in size between eggs of the Indian Bustard and those of the Lesser Florican, and they resembled a common type of the former in colour, but the markings are more decided. They are in fact what one would call typical bustards' eggs.

They are broad oval in shape, very slightly pointed at one end. The ground-colour is a dark reddish-, or greenish-brown, in some inclining to a darkish drab; the markings consist of clouds and blotches of reddish-, and blackish-brown.

The average of the nine eggs was 2·4 inches in length and 1·8 in breadth.

839.—THE LESSER FLORICAN.

Sypheotides aurita, Lath.

The Likh or Lesser Florican, if it occurs at all in Upper Sind, must be very rare ; in the lower portion near Karachi, a few couples are shot annually during the rains.

It is very common at this season in suitable places throughout Rajpootana and Gujerat.

It is apparently a permanent resident in many parts of the Deccan, but occurs very rarely in Ratnagiri and Kanara.

It frequents grassy plains and growing crops, avoding thick tree-jungle, and does not ascend the hills to any great height.

They appear to be getting scarcer every year, owing to the merciless manner in which they are shot by sportsmen and others during the breeding season, which lasts from the end of August to the commencement of November, most eggs being laid towards the middle or end of September.

In the early morning, and even all day long when it is cloudy, the cocks during the breeding season have a habit of springing in the air, uttering at the same time a frog-like call, evidently to attract the females.

Native shikaries take advantage of this habit, and go out to likely places at day-break and mark them down, their masters coming out later in the day, have these spots beaten, as the birds remain in the vicinity for days together. The cock bird usually falls a victim at these times, not from any mercy shown to the females by the gunners, but owing to the greater difficulty in flushing them, they having a habit of running some distance under cover before taking wing; the cocks on the other hand usually rise freely and offer easy shots.

It would be very difficult to prevent them from being shot at this season, and nothing less than the most stringent game laws, rigidly and impartially enforced, seems likely to be of any use.

People argue that if they don't shoot them others will, and if they did not shoot them at the breeding season, they could never shoot any at all, as the birds disappear soon after the breeding season is over, and they would only be benefiting people in far-off districts.

The eggs, four in number, are placed in a depression in the ground sheltered by a tussock of grass or stunted bush (there is no nest to speak of) generally in thin grass jungle. They are hard to find.

In shape they are broadish ovals, pointed more or less at one end, the ground-colour is usually a dark oily-, or olive-green, streaked and clouded with reddish-brown.

Dark olive-brown, clear almost sap-green, drab, and stone-coloured varieties occur, and the markings vary from reddish-brown to brown.

They average 1·87 inches in length by rather more than 1·6 in breadth.

Baroda, August and September.	*H. Littledale, B. A.,*
Deesa, September to October.	*H. E. Barnes.*
Neemuch, August to October.	*Do.*
Mhow, September.	*Do.*

840.—THE INDIAN COURIER PLOVER.

Cursorius coromandelicus, Gm.

In Upper Sind the Indian Courier Plover is comparatively rare, being replaced to a great extent by the European Courser.

I have myself however observed the present species as far north as the plain near the Chota Bolan Pass.

Mr. Doig found the present species breeding in the Eastern Narra. Mr. Davidson records it from Khandeish.

It is common in suitable places in the Deccan and the rest of Western India, with the exception of Ratnagiri and Kanara, where it is rare.

It frequents open sandy plains and cultivated ground, before the crops are much grown, and again after they are reaped, when the fields are covered with stubble. They avoid marshy and forest tracts, and do not ascend the hills.

I believe it is more or less a permanent resident where it occurs, but the only place where I have personally taken eggs is at Neemuch, where the birds are very common; at times flocks of them come on the parade ground, quite close to the barracks, and on the large open plain near the Parsee Tower of Silence they simply swarm at all times of the year.

The eggs, two in number, occasionally three, are deposited on the ground in small hollows scraped by the birds themselves, in the most open places, and without the slightest pretence to a nest.

They are, however, very difficult to find, as they assimilate so closely in colour with the ground on which they are lying. I have often all but trodden upon them, while searching for them, although I knew from the movements of the birds, that eggs were close at hand.

They are almost spherical in shape, measuring about 1·19 in length by about 0·97 in breadth; the ground-colour varies from cream to bright buff, or yellowish-stone colour, and they are blotched and spotted with pale inky-grey, and above this are lines, scratches, and streaks of dark-, or blackish-brown. These markings are generally small and close set, with an occasional inky-black smudge or smear intermingled.

Neemuch, March and April. *H. E. Barnes.*
Eastern Narra, Sind, July. *B. S. Doig.*

840.—THE EUROPEAN COURIER PLOVER OR CREAM-COLOURED COURSER.

Cursorius gallicus, Gm.

The Cream-coloured Courser is absent from the southern portion of Western India; it occurs as a more or less common cold weather visitant in Guzerat and Rajpootana and in Upper Sind; in suitable places it is fairly common, and said to be a permanent resident, breeding in July.

The eggs, two or three in number, cannot be distinguished from those of the preceding.

Mr. Hume, to whose kindness I am indebted for a clutch of eggs, which he received from the Sirsa district, thus describes them :—

"Typically the eggs are very broad ovals, only very slightly compressed towards one end, but here and there slightly elongated varieties occur, except that the ground-colour is yellower and more buffy, many of the eggs, both as to shape and markings, appear perfect miniatures of some of the varieties of *Esacus recurvirostris* (the Large Stone Plover).

"They have of course no gloss.

"The ground-colour is pale-buff or creamy-stone colour, and the most characteristic feature in the egg is the huge dull half-washed-out inky clouds which underlie the brighter or primary markings, which latter vary from black to olive-brown.

"In some eggs, the secondary markings cover half or more than half the surface of the egg, and are sooty black; in others they are not only smaller but much less conspicuous, being a faint inky-purple.

"Typically the primary markings are very niggly in their character, a combination of specks and spots and fine irregular lines, some black or blackish-brown, some olive-brown, thickly sown over the whole surface of the egg. Not unfrequently, however, some few among the markings are bolder and coarser, and stand out more or less conspicuously from the general scratchy, mottled mass of markings.

"In some eggs the olive-brown is wholly wanting, and in one egg before me, the only representatives of the primary markings are a number of large blotches and spots of a very rich olive-brown.

"Occasionally the primary and secondary markings are so dense, that between them every particle of the ground-colour is concealed. Some of the eggs not a little resemble those of *Glareola pratincola* both in size and appearance, but the majority are larger and have smaller and more niggling markings than the eggs I have seen of *G. pratincola*."—(*Hume's Nests and Eggs of Indian Birds, p.* 567.)

842.—THE LARGE SWALLOW PLOVER.

Glareola orientalis, Leach.

Mr. Davidson records the Large Swallow Plover from the Deccan, having seen birds on the Bhima River about 40 or 50 miles south of Sholapur; I am not aware of any one else having met with it, so that it must be extremely rare.

They appear to be not uncommon in suitable places in Sind, notably in the Eastern Narra district, where Mr. Doig found them breeding in company with the Collared Pratincole.

He does not describe the eggs. I, therefore, reproduce a description by Mr. E. W. Oates, who found them breeding in Burma, during April and May.

"The ground-colour is stone or buff-coloured, and the whole shell is thickly blotched with blackish-brown and underlying smears of paler brown sunk into the shell. Other eggs are so thickly blotched as to appear black, when viewed at a short distance off. They are without gloss and plover-like, one end of the egg being much pointed. In size they vary from 1·25 to 1·12 inches in length, and from 0·96 to 0·9 in breadth, but the average of a considerable series is 1·8 by 0·93."—(*Stray Feathers, Vol. III., p. 50.*)

To this Mr. Hume adds a footnote,—

[This is especially noteworthy as showing that, in its eggs, this species diverges widely not only from *Glareola lactea*, but from its extremely closely allied congener, *Glareola pratincola*. The eggs of the former * * * * * * are not in the least plover-like, but rather tern-like, and of the latter Mr. Hewitson says:—"In shape and colour they bear a much closer resemblance to the eggs of the Black Tern, than to those of any other British bird; they are not at all like the pointed eggs of the true Waders," by which he means to refer to the Plovers, Godwits, Snipes, &c.]

842*bis*.—THE COLLARED PRATINCOLE.

Glareola pratincola, Lin.

Mr. Vidal obtained a specimen in Ratnagiri; this is the only recorded instance that I can find of its occurrence within our limits outside the Province of Sind.

Mr. Doig found them breeding in company with the Large Swallow Plover (*Glareola orientalis*), and I cannot do better than reproduce the account he gave of it in the pages of *Stray Feathers** :—

"On the 4th May I came across a lot of birds, which were new to me, so I shot some to identify; from the persistent way in which the others kept flying round and round, I concluded that they must be breeding, and on searching for their nests I found some half-dozen all empty, and so thought that they were beginning to lay.

"I accordingly left the place and returned on the 7th, when I found after searching about that what I had taken for new nests were really old ones, the place round about being covered with the broken egg shells; however, by patient searching I collected over fifty eggs. The breeding ground was about fifteen acres in extent (the actual portion where most of the nests were placed was only about an acre), and was a salt plain with patches of coarse sedge here and there on it, the whole being surrounded by dense tamarisk and rush jungle, and was situated about half a mile from the bank of the Narra.

"The nests were slight hollows scraped in the ground, and were generally situated close to where the soil had been rooted up by wild pigs, or in the centre, or by the side of, a lump of dried cowdung: this latter was the favourite situation. The greatest number of eggs in any nest was three. This seemed to be the normal number, but some contained only two, and one had a single egg, and one young one, just hatched. I shot several specimens which I have preserved and sent to Mr. Hume, for identification, along with their eggs. As one or two of the specimens appear to me to be undoubted *orientalis*, I have entered this note against both, as I conclude that both must have been breeding in company. I also found *Cursorius coromandelicus* and *Lobivanellus indicus* breeding in the same place.

"These birds have a most peculiar habit of lying stretched on the ground with their wings spread out; they not only did this while I was visible, searching for their eggs, but when I had disappeared and lay hid in the dense jungle, I saw them through my glasses going through the same antics. As far as I could judge, it was done when any other bird approached the nest or young, and was evidently a sign of anger. Two birds which I shot while thus extended were both males. The ground-colour of the eggs is a light dirty green in some, in others drab, covered all over with dark purple blotches, denser in some than in others, and sometimes forming a zone at the broader end; some are in shape broad ovals, others nearly spherical; they vary in length from 1·1 to 1·35 and from 0·8 to 1·05 in width, the average of 52 eggs being 1·26 in length and 0·95 in width."

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* *Stray Feathers*, Vol III., p. 375.

843.—THE LESSER SWALLOW PLOVER.

Glareola lactea, Tem.

The Lesser Swallow Plover occurs along most of the larger rivers in Western India.

Mr. Davidson found it to be not uncommon during the cold weather along the river Bhima; Mr. Littledale found it breeding near Baroda, and I myself found it breeding in some numbers on the sandy islands in the bed of the river Indus, near Kotri; it had not previously been recorded from Sind. I find from my note book, that I shot my first specimens on the 20th February, 1881; on dissecting them I found the testes very large and the ovaries well developed, showing that they were about to breed. Early in March I sprained my knee, and was unable to go after them, but on the 10th I managed to drive along the banks of the Indus, and about a mile down stream I found a small island, literally swarming with birds, evidently breeding. They comprised the following kinds:—*Sterna seena, Sterna melanogastra, Rhynchops albicollis, Glareola lactea,* and a pair of *Esacus recurvirostris.* I made arrangements next day to have the eggs taken. I could not go myself, as I could scarcely put my foot to the ground, so I sent a Bhil shikaree, with my gun, (as I wished him to shoot specimens, to prevent mistakes as much as possible), but he was arrested before he had gone half a mile for carrying arms, and the gun was taken from him, and it was only after a deal of bother that I got it back. On the 15th I again drove down, but found that during the night the river had unexpectedly risen, and the sandy island was submerged. On the 3rd April I again went down, and crossing the river made as thorough a search as was possible. On a sandy bank, just below Kotri, I found it very trying work, as my crutches (I could not dispense with them) sank several inches into the sand at every step. My diligence was rewarded by finding three nests (or holes would be the more correct term) containing, respectively, two, two, and one egg, all much incubated, not so much but they made decent specimens.

The two pairs were of the usual type, but the single egg was very deficient in colour, and densely clouded at the larger end with pale underlying patches of inky-purple. The spot where I procured these eggs was not an unfrequented one, neither was it a spit of land running into the water, and scores of boatmen and others passed it daily, yet the eggs were not in any way concealed. At the time I attributed the cause of their being but one or two eggs in each batch, to the birds having commenced to lay upon the island before it was flooded, and were forced to finish laying in the nearest suitable place.

I now think that they do not, in Western India at all events, usually lay more than two eggs, as in 1887, I was again stationed at Hyderabad, Sind, and again found them breeding, during March and April, in the same place, but in no single instance did I find more than two eggs or two young in the same nesthole. Mr. Littledale's experience tallies with mine; he found them breeding, early in April, on a small rocky island, a mile above Sehora on the Mahi; he found about 18 eggs altogether, but never more than two in one place.

Mr. Hume and others give four as the maximum number, but state that two only, fully incubated, are often found.

The eggs are deposited in shallow holes, scraped in the sand, often out in the open, exposed to the full rays of the sun, but usually they are placed under the shelter afforded by a tuft of grass, or small tamarisk bush. These depressions are scraped by the birds themselves.

Mr. Littledale found eggs on the ground under a ledge of rock.

The eggs vary a good deal, but are typically broad ovals, pointed at one end; the ground-colour varies from a pale greenish-white to fawn colour. Occasionally eggs are found having the ground-colour a pure white, and others much darker, approaching to reddish-brown;

the markings consist of specks and streaks of different shades of olive and reddish-brown.

They average rather more than an inch in length by about 0·82 in breadth.

Kotri, Indus, Sind, March and April. *H. E. Barnes.*
Sehora, Mahi, Guzerat, April. *H. Littledale.*

848.—THE KENTISH RINGED PLOVER.

Ægialitis cantianas, Lath.

The Kentish Ringed Plover occurs all along the coast and on the banks of the rivers near the sea. It is occasionally found some distance inland. Practically it is a cold-weather visitant only, but it has been proved, beyond a doubt, that some few do remain behind and breed, but for reasons fully detailed in the Society's Journal,* I believe that, as a rule, these are young birds.

To Mr. J. W. N. Cumming belongs the credit of being the first, and up to date, the only collector, who has obtained their eggs in continental India. He found a clutch of three eggs, near Karachi, on the 25th April, 1887, and on the 9th May he found three nestlings. He shot one of the parent birds, which he sent to the Honorary Secretary of the Bombay Natural History Society, for identification, and it was inspected by myself and others. It was however a young bird (not being in adult plumage), which would perhaps account for the eggs being rather smaller then the average of European ones. These eggs were found in a slight depression in the sand, at the base of a small hillock not far from the sea; the nestlings also were found in a similar situation, near the same place. Mr. Cumming kindly sent one of these eggs for my nspection, and I carefully compared it with European eggs in my own collection, and found that with the exception of being slightly smaller it was exactly similar both with regard to ground-colour, and character of markings: on the other hand, it differed considerably from eggs of the Lesser Ringed Plover: in the first place, the markings are larger and more distinct, and have not that scratchy and speckly appearance that characterizes the latter, and, secondly, the egg is somewhat larger than any egg I have ever seen of the Lesser Ringed Plover.

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* *Journ. Bombay Nat. Hist. Soc.*, Vol. II., p. 167.

This egg measured 1·25 inches in length by 0·87 in breadth.

Colonel Legge obtained the eggs in Ceylon; Doctor Scully found them in Eastern Turkestan, and Colonel Butler caught a young bird, unable to fly, on the sandy plain at Jashk, just outside our limits.

849.—THE INDIAN RINGED PLOVER.

Ægialitis dubia, Scop.

The Indian Ringed Plover occurs in suitable places (that is, along the banks of rivers and on the shores of the lakes) throughout the Presidency.

It is stated to be a permanent resident, but I cannot help thinking that some mistake has been made, as both myself and others have found that all the eggs of the Ringed Plovers, taken by us, have unmistakably belonged to the next species.

850.—THE LESSER RINGED PLOVER.

Ægialitis minuta, Pall.

This is, I believe, the Common Ringed Plover of Western India, and occurs in similar places to the last. It is a permanent resident, breeding abundantly during March and April. There is no nest; the eggs, three in number, are placed on the sand, in the bed of a river; they are oval in shape, much pointed at one end, and are of a yellowish stone-colour, marked with thin scratchy streaks of blackish-brown.

They measure 1·2 inches in length by about 0·83 inches in breadth.

These tiny plovers exhibit great anxiety if any one approaches the spot where they have incubated eggs or young: a detailed account of this is given in the 1st volume of the Society's Journal, page 57.

Deesa, March.	*H. E. Barnes.*
Neemuch, March and April.	*Do.*
W. Khandesh, Do.	*J. Davidson, C.S.*
Baroda, April.	*H. Littledale, B.A.*

855.—THE RED-WATTLED LAPWING.

Lobivanellus indicus, Bodd.

The Red-wattled Lapwing is common in the vicinity of rivers, tanks, and marshes throughout the Presidency.

They are permanent residents, breeding during April, May and June. Eggs may be obtained as early as the first week in March and as late as the third week in August, but the majority of the birds lay in the months stated. I do not think that they have more than one brood, as a rule, but if the first eggs be taken, and the birds be not otherwise persecuted, they will lay a second and even a third time in the same vicinity.

They are not particular in choosing a site for a nest, provided that water be not very far off; melon fields, irrigated gardens, borders of swamps, banks of rivers, and such like places, until the monsoon breaks, after which they prefer drier spots, often some little distance from water. There is no nest, the eggs, invariably four in number, are placed in a depression on the ground, in many cases surrounded by a border of small stones, clods of earth, or loose sand. The eggs are very broad at one end, and much pointed at the other, but they are subject to variation.

They average about 1·65 inches in length by nearly 1·21 in breadth. The ground-colour varies from pale olive-green to reddish- or yellowish-buff, and the markings, consisting of blotches, streaks, and spots, are deep brown, almost black in some specimens; besides these markings, many have pale washed-out underlying patches of faint inky-purple.

The anxiety exhibited by these birds when any one approaches the spot where they have young, and the wiles they make use of to entice him away, quite equals all that has been written about the Peewit.

856.—THE YELLOW-WATTLED LAPWING.

Lobipluvia malabarica, Bodd.

The Yellow-wattled Lapwing is more or less common in suitable localities throughout Western India, but is somewhat rare in Ratnagiri. It is not found in the vicinity of rivers and marshes as a rule, being more a bird of the uplands, where it breeds during the months of April and May. The eggs, always four in number, are placed in a depression on the ground, usually out in the open, rarely is advantage taken of a tuft of grass or bush.

These depressions are often surrounded by a ridge of loose sand, or small stones, much in the same way as those of the Red-wattled

Plover. The eggs are of the typical plover-shape, measuring 1·45 inches in length by about 1·05 in breadth. The ground-colour varies from yellowish-buff to greenish-stone; the markings, consisting of spots, streaks, and blotches, are pale olive-brown and dingy purple.

Neemuch, April and May.	*H. E. Barnes.*
Nassick, do.	*J. Davidson, C.S.*
Panch Mahals, April.	*H. Littledale, B.A.*

858.—THE GREAT STONE PLOVER.

Esacus recurvirostris, Cuv.

The Great Stone Plover is very common in Sind along the Indus, wherever there are sandy and stony islands; it is not uncommon in similar places on the rivers of Guzerat and Rajpootana, but appears to be more rare in most other parts of Western India.

Mr. Littledale found them breeding on the Mahi, Colonel Butler met with it on the river between Ahmedabad and Deesa, Mr. Davidson procured it in Western Khandeish, and I shot a single specimen on an island in the river near Neemuch.

They are chiefly found on rocky and sandy islands in the beds of the large rivers, but occur occasionally on the sea coast.

They breed from early in March to about the middle of April; the eggs, two in number, are placed in a hollow on the ground, generally on an island that is not much frequented, especially if it is interspersed with rocks; of course it is only on the larger rivers that such islands are found.

They are broad oval in shape, somewhat pointed at one end, but not so much as those of the Red-wattled Lapwing.

Usually the ground-colour is a stony-drab, but cream and pale olive-brown varieties are not uncommon; they are streaked and blotched with olive-, umber-, and blackish-brown, and have faint underlying spots and clouds of faint inky-purple.

They vary a good deal in size, but the average is about 2·15 inches in length by 1·6 in breadth.

They seem to lay their eggs on the same spot year after year.

Kotri, Indus, March.	*H. E. Barnes.*
Sehora, Mahe, April.	*H. Littledale, B.A.*

859.—THE STONE PLOVER.

Ædicnemus scolopax, S. G. Gm.

The Stone or Norfolk Plover is common in suitable places in most parts of Western India, but appears to be rare in Ratnagiri and the South generally.

They frequent sandy, scrub-covered plains, low bush jungle, and thin grassy groves. They are permanent residents where found. A few eggs may be taken as early as February and as late as August, but the majority of the birds lay in April. Their eggs, two in number, occasionally three, are laid on the ground, under the shelter of a bush or tussock of grass, amongst dead leaves, which match the eggs so perfectly that they are often overlooked, even when one is in search of them. Were it not for seeing the parent birds creeping away, with heads bent down, they would often be passed over.

The eggs are broad oval in shape, and the ground-colour varies from a yellowish-white to a pale buff brown, streaked, speckled, and blotched with olive- and blackish-brown, and having a few faint spots of inky-purple.

They average 1·9 inches in length by nearly 1·39 in breadth.

Deesa, April.	*H. E. Barnes.*
Neemuch, April, 8th May.	*Do.*

861.—THE CRAB PLOVER.

Dromas ardeola, Pay.

The Crab Plover is not uncommon on the sea coast, and although so far as I know the egg has not been taken within our limits, yet I feel sure that sooner or later it will be.

They breed abundantly in some of the islands in the Persian Gulf; Colonel Butler gives a very full account of them, in *Stray Feathers*, Vol. viii., p. 381, *et seq.*

Contrary to what might have been expected, considering the affinities of the bird, they do not lay two stone-coloured, well-marked eggs, on the ground, but only one, and that is placed in a burrow in the sand.

The egg is pure white, oval in shape, pinched in at one end, and measures 2·54 inches in length by 1·77 in breadth.

They breed during the months of May and June.

NOTES ON A COLLECTION OF BUTTERFLIES MADE IN THE CHIN-LUSHAI EXPEDITION OF 1889-90.

By E. Y. Watson.

The following collection was made from the Burmese side in the Chin-Lushai Expedition of 1889-90, and so differs considerably from that made from the Chittagong side, of which a list was recently published in the Journal;* in fact, I only met with forty-six of the eighty-four species there recorded.

This collection was made almost entirely in the Yaw district, between October, 1889, and May, 1890, though a few species were obtained at Loungat (1,500 feet) and Choungkwa (1,760 feet) in the Chin Hills, during May.

The Yaw district for the purposes of this paper may be considered to begin at Pauk, about 50 miles west of Pokoko on the Irrawaddy, and to extend another fifty miles west to Tilin on the Maw river which forms the western boundary of the district. The Maw runs due north from Tilin, falling into the Myittha after about 30 miles, which latter river continues to flow north for another 150 miles, finally falling into the Chindwin; collections, however, were only made as far as Kan, about 70 miles north of Tilin.

Nearly the whole of the collection was made at Tilin, between December and May, but during November a certain number of butterflies were caught at Pauk, and along the road from Pauk to Tilin, but nearly all the species then obtained were subsequently met with at Tilin. During September two Native collectors from the Phayre Museum, Rangoon, were employed in catching butterflies in the neighbourhood of Pokoko, one of whom during October went as far as Tilin, collecting *en route,* but returned at the end of that month utterly incapacitated through fever, and I had to send him back to Rangoon. The other continued to collect round Pokoko till the end of October, and then accompanied me to Tilin, from which place he went sick in February. It was most unfortunate his going sick so early, as all the spring broods appeared during March and April;

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* Journal, Bombay Natural History Society, Vol. v., No. 3, p. 295 (1890).

these being far and away the best months. The collections made by these men at Pokoko are also included in the following paper.

Round Pokoko the country is sandy, covered with low scrub, and quite devoid of big jungle; this description of country continues pretty well as far as Pauk, and is not productive of many species.

Beyond Pauk, the nature of the country entirely changes, and the greater part of the road to Tilin leads through fairly thick tree-jungle. About a couple of miles from Tilin the forest changes to what is known in Burma as *eng* jungle, the *eng* being a tree with large shiny leaves bearing a distant resemblance to teak, the soil in this jungle being a quartzy gravel. This description of jungle is nearly devoid of life, animal or insect, almost the only butterflies occurring in it being *Arhopala*, and these in no great numbers.

At Tilin the collection was made almost entirely in two small nullas about a couple of miles in length, which fall into the Maw; as these two nullas were almost identical a description of one will suffice. The nulla itself is a few yards wide with perpendicular banks nine or ten feet in height, above which the sides slope up steeply to about a couple of hundred feet. However, at each bend of the nulla the perpendicular bank on the inside is converted into a gentle slope covered with small bushes. Here and there in the lower part of the nulla are small pools, but these quite cease after the first mile or so, and the bed consists of dry quartzy gravel to its source. For the greater part of the way the *eng* is separated from the nulla by a belt of bamboo and other jungle, but towards the source of the stream the bamboo disappears and the *eng* meets from either side. The elevation of Tilin is about 1,100 feet, there being a slight ascent from Pauk, which is about 800 feet, though on the road between two ranges of hills are crossed, both of which slightly exceed 2,000 feet.

As already stated, the best months were March and April, and during the former month in certain places where the nulla runs between perpendicular banks, the air would be thick with numberless *Neptes*, while every step roused up dozen of *Melanitis* and *Lethe europa*, and here and there an assemblage of *Euplœa* and *Danais* (chiefly *E. godartii* and *D. melanoides*) would be seen dotting the sides of the banks. In the upper part of the nulla, where water entirely failed, these species disappeared, and were replaced by *Arhopala*, which were very numerous both in species and individuals.

At the end of May I made an attempt to get from Kan to Haka, the latter being the military post recently established in the Chin Hills from the Burma side; however, I was knocked over with fever at Choungkwa the second march out, and had to return; but still on the road out I was fortunate enough to obtain several species I had not before met with. Choungkwa is at an elevation of only 1,760 feet, but though not much higher than Tilin, it is very differently situated, as Tilin is practically on the highest ground for some miles round, while Choungkwa is in a hollow surrounded by hills on all sides, those immediately over it rising almost uninterruptedly to a height of between four thousand and five thousand feet.

It will be seen that of the 276 species recorded no less than 257 were obtained at Tilin, and this list is by no means exhaustive, as during the last fortnight of my stay there I caught nine species not previously obtained. The months during which the collection was made practically represent the dry season, as normally the rains cease in Yaw about the end of October and commence again in June, though as a matter of fact in 1889 the rains were unusually late, and did not cease till the end of November; still this did not affect the butterflies to any great extent, as there had been a longish break early in November, and consequently almost entirely dry-weather forms were obtained. In connection with these forms it is worthy of note that during the last week in March and during the whole of April and May, *Junonia asterie*, which is almost without doubt the dry-season form of *J. almana*, occurred with the latter in about equal numbers. I am unable to account for this in any way; there was a mango shower early in March, but absolutely no rain from then till the end of April, so it cannot be accounted for by the chrysalides having been affected by damp and the imagines so modified, as is probably often the case. The two forms of *Catochrysops pandava* also appeared without any particular regard to their proper seasons. I am unable to say what the rainfall is in the Yaw district, but at Tilin it is probably about 100 inches; at Pokoko the rainfall is usually something under 30 inches.

NYMPHALIDÆ.

(Species marked * have been identified by Mr. de Nicéville.)

1. *Danais melanoides*, Moore.

   Pauk, September; Pauk to Tilin, November; Tilin, December to May; Choungkwa, May. All much smaller than specimens from North India.

2. *Danais limniace*, Cramer.

   Pokoko, Pauk, September; Tilin, November to May.

3. *Danais septentrionis*, Butler.

   Tilin, February, March. Only two specimens obtained.

4. *Danais chrysippus*, Linnæus.

   Pokoko, Pauk, September; Pauk to Tilin, November; Tilin, December to May.

5. *Danais genutia*, Cramer.

   Pauk, September; Tilin, December to May.

6. *Euplœa rogenhoferi*, Felder.

   Tilin, December. A single female.

7. *Euplœa erichsonii*, Felder.

   Tilin, March and April. Three males and two females; the males all of the form *apicalis*, and both females of the form *pembertoni*.

*8. *Euplœa klugii*, Moore.

   Pauk, October; Tilin, March to May. Fourteen males and five females, showing considerable variation in the markings, some specimens having complete marginal, submarginal and discal rows of spots on forewing as well as a spot in cell, and others having only a submarginal row, all other spots being absent. All these specimens are glossed with purplish-blue to the extreme edge of the forewing, and are readily recognisable as *klugii*.

   In addition to the above, I obtained the following seven males of this species. To all appearance they are very distinct from *klugii* and might belong to seven different species. However, I have submitted them to Mr. de Nicéville, and he has decided, by the aid of the specimens at his command, that they are all varieties of *klugii*. As none of them agree with the varieties described by Moore,* (*indigofera*, *imperialis*, etc.), I have described them separately below:—

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* Proc. Zool. Soc., Lond., 1883, pp. 306, foll.

Variety 1—Of large size. UPPERSIDE, *forewing*, dark brown, brilliantly shot with deep indigo-blue to extreme edge of wing, a submarginal row of eight white spots, the lower three dusted with violet, and a marginal row of twelve white dots in pairs, no discal spots. *Hindwing*, paler brown, faintly shot with blue in cell, with prominent marginal and submarginal rows of white spots, obsolete anteriorly. UNDERSIDE, reddish-brown. *Forewing*, paler along inner margin, one subcostal spot above end of cell, four discal spots, four apical submarginal dots, and complete row of marginal dots. *Hindwing* with spots as on upperside.

SEXUAL BRAND, long and narrow. EXPANSE: 3·9″.

A single male obtained at Pauk in September.

Variety 2—Of smaller size. UPPERSIDE, *forewing*, very dark brown, shot with deep indigo-blue to extreme edge of wing, five submarginal white dots, otherwise unmarked. *Hindwing*, dark brown without blue shot, three submarginal apical white dots, remainder of row very faintly traceable as pale brown spots, marginal row also very faint and pale brown. UNDERSIDE, reddish-brown. *Forewing*, with one subcostal spot above end of cell, four discal spots, submarginal row incomplete at both ends, and marginal row of minute dots, these spots all white. *Hindwing* with two complete rows of prominent white spots.

SEXUAL BRAND, short and oval. EXPANSE: 3·6″.

A single male obtained at Tilin in April.

Variety 3—UPPERSIDE, dark brown. *Forewing* very broad, shot with brilliant blue as far as submarginal rows of spots, five apical submarginal white spots, of which the third is the largest, ten marginal white dots in pairs, three very faint discal violet streaks, and one minute subcostal violet spot above end of cell. *Hindwing* paler, faintly shot with blue in cell, a submarginal row of six white spots, of which the first two are very prominent and remainder minute, a marginal row of minute white dots. UNDERSIDE, brown.

Forewing, with one subcostal and four discal white spots, five apical minute dots, and a complete row of marginal dots. *Hindwing*, with two complete rows of prominent white spots.

SEXUAL BRAND, short and oval. EXPANSE: 3·3″.

A single male obtained at Tilin in March.

Variety 4—UPPERSIDE, dark brown. *Forewing* broad, shot with purplish-blue to extreme edge of wing, eight submarginal spots, of which the first two are small and remainder decreasing from the third, which is largest; a complete row of marginal white dots in pairs, the third, fourth, and fifth of the submarginal row coalescing with the corresponding pair of marginal dots, disc unmarked. *Hindwing*, paler, faintly glossed with blue in cell, upper three of submarginal row white and prominent, remainder faint, complete row of marginal white spots. UNDERSIDE, similar to the preceding variety, except that the submarginal row of spots on forewing is complete.

SEXUAL BRAND, short and oval. EXPANSE: 3·2″.

A single male obtained at Tilin in March.

Variety 5—Of very small size. UPPERSIDE, *forewing*, dark brown, shot with blue to extreme edge of wing; and with the following violet-white spots:—one in cell, one subcostal, three discal, six submarginal, of which the second is largest, and five minute submarginal ones towards inner angle. *Hindwing*, paler, shot with blue in the cell, three upper minute white submarginal dots, remainder of row and whole of marginal row wanting. UNDERSIDE, paler. *Forewing*, with four discal, one subcostal, and incomplete rows of marginal and submarginal white dots; *hindwing* with two complete rows of small but prominent white dots.

SEXUAL BRAND, short and oval. EXPANSE: 2·8″.

A single male obtained at Tilin in May.

Variety 6—UPPERSIDE, dark brown, with broad paler margins. *Forewing*, shot with purplish-blue to just beyond cell, two minute discal violet streaks, eight submarginal spots, of which the third is large and remainder small, and an incomplete row of minute white dots. *Hindwing*, faintly shot with blue in cell, three upper submarginal white spots, remainder of double row wanting. UNDERSIDE, paler. *Forewing*, with one subcostal and three discal white spots, and a double incomplete row of white dots. *Hindwing*, with two rows of prominent white spots.

SEXUAL BRAND, short and oval. EXPANSE: 3·1″.

A single male obtained at Tilin in May.

Variety 7—UPPERSIDE, pale brown. *Forewing*, darker towards base, where it is shot with purple, two minute violet discal streaks, seven submarginal spots, of which the upper two are minute, remainder equal-sized, round and very prominent, no marginal dots. *Hindwing*, shot with blue in cell, with three upper submarginal white dots, remainder of double row wanting. UNDERSIDE, paler. *Forewing*, with one subcostal and four discal spots, all very minute except lowest discal spot which is large and prominent, two incomplete rows of white dots. *Hindwing*, with two complete rows of white spots.

SEXUAL BRAND, oval and very faint. EXPANSE: 2·95″.

A single male obtained at Tilin in April.

9. *Euplœa linnæi*, Moore.

Pauk to Tilin, October, November; Tilin, December to May.

10. *Euplœa subdita*, Moore.

Pauk, September; Tilin, March. Two males.

11. *Euplœa godartii*, Lucas.

Pauk, September; Pauk to Tilin, October, November; Tilin, December to May.

12. *Euplœa binghami*, Moore.

Tilin, February, March. Two males. This species can readily be distinguished from *E. subdita*, by the absence of the blue gloss, and by having the apical spots on upperside and underside of forewing less prominent. From *E. godartii* it can only be distinguished by the absence of the violet apical patch, and may be only a casual variety of that species, since in *E. godartii* the patch varies greatly in extent, and in some specimens is scarcely traceable.

13. *Euplœa deione*, Westwood.

Tilin, December, April, May. Two males, two females. In these four specimens the white dots on upperside of forewing vary from one to four, the spots on the underside of forewing being also very inconstant, one female having two complete rows of marginal spots and the other having only three dots near anal angle. The males are shot with blue to the extreme edge of the wings, the females have an unglossed black border along outer margin and extending along costa about as far as the white costal dot.

14. *Euplœa binotata*, Butler.

Tilin, December to May. Six males, two females. This species varies greatly in the prominence of the spots on the upperside of the forewing, and also in the number of the white submarginal dots on upperside of hindwing. My specimens apparently include *E. microsticta*, Butler, but not *E. hopei*, Felder, (*E. hopei*, Marshall and de Nicéville, =*E. binotata*, Butler), *E. regina*, Moore, or *E. pygmæa*, Moore.

15. *Mycalesis runeka*, Moore.

Pauk to Tilin, November; Tilin, December to May. Only the unocellated form obtained, the white discal band of underside is frequently wanting.

16. *Mycalesis perseus*, Fabricius.

Tilin, January. A single unocellated specimen.

17. *Mycalesis mineus*, Linnæus.

Ocellated: Pauk, September. Two specimens.

Unocellated: Pauk to Tilin, November; Tilin, December to April. Numerous specimens.

18. *Mycalesis lepcha*, Moore.

Ocellated: Pauk to Tilin, November.

Unocellated: Tilin, March to May. The dry season form of this species is, according to Mr. de Nicéville, not separable from *M. lepcha*, but the rainy-season form is very distinct from *M. malsara* on underside, being in fact almost identical with *M. mineus.*

19. *Mycalesis mystes,* de Nicéville.

Ocellated: Pauk to Tilin, November.

Unocellated: Tilin, March.

The ocellated form is superficially very similar to *M. mineus* and the unocellated to *M. langi*; both forms however are readily identified by the presence in the male of a black tuft of hair on the upperside of the hindwing along the submedian nervure. This species will shortly be described by Mr. de Nicéville as the type of a new subgenus.

20. *Mycalesis mnasicles,* Hewitson.

A single very worn specimen at Choungkwa in May.

*21. *Lethe vindhya,* Felder.

Tilin, March. Three males, one female. The female differs from the male only in having the fuscous band on upperside of forewing paler, and therefore more distinct, and on the upperside of the hindwing in having the ocelli larger, and the margin from tail to anal angle suffused with chestnut-red.

22. *Lethe mekara,* Moore.

Tilin, May. One male, one female.

23. *Lethe europa,* Fabricius.

Pauk to Tilin, November; Tilin, November to May. Very common.

24. *Lethe dryta,* Felder.

Pauk to Tilin, October; Tilin, March and May. Two males, one female.

25. *Lethe rohria,* Fabricius.

Pauk to Tilin, November; Tilin, March. Three males, one female. Differ from specimens from Upper Tenasserim in being blacker on the underside, instead of having the ground-colour a chocolate-red.

*26. *Neope bhima,* Marshall.

Pauk to Tilin, October, November; Tilin, November, April, and May. Nine males, four females. Those caught at the end of the year were in poor condition; the spring brood appeared about middle of April, and did not differ in markings from the autumn brood. It settles almost invariably on tree-trunks, on which I usually obtained it in the very early morning: it is crepuscular in its habits, but does not seem to frequent very dense jungle. The female is larger than the male and has all the ocelli larger. All my specimens differ from the figure in "Butterflies of India," in having only four ocelli on the underside of the forewing, the lowest blind ocellas being wanting. When seen either at rest or on the wing, this species seems altogether out of place in this fauna, and one would rather expect to find it sitting on stones in the hills in company with *Hipparchias*. It rests with its wings closed over the back, its underside harmonizing well with the bark of tree-trunks.

27. *Yphthima philomela*, Johannsen.

Pauk to Tilin, November; Tilin, December to May.

All unocellated except those caught in November.

28. *Yphthima savara*, Grose-Smith.

Tilin, March, April. A few specimens, all with small ocelli.

29. *Yphthima huebneri*, Kirby.

Typical: Pauk, September; Pauk to Tilin, November.

The unocellated form, *T. howra*, Moore, obtained, Pauk to Tilin, November; Tilin, November to April.

30. *Yphthima avanta*, Moore.

Strongly ocellated: Pauk, November. With small ocelli. Tilin, March and April. A few specimens only.

31. *Melanitis leda*, Linnæus.

Typical: Pauk, September; Pokoko, October. Two specimens.

The unocellated form *M. ismene*, Cramer, obtained, Pauk to Tilin, November; Tilin, November to May.

32. *Melanitis aswa*, Moore.

Tilin, December. A single specimen. This is in all probability the rainy-season form of *M. bela*.

33. *Melanitis bela*, Moore.

Pauk to Tilin, November; Tilin, December to April. Occurred commonly.

34. *Melanitis duryodana*, Felder.

Pauk to Tilin, November; Tilin, November, December. Three specimens only. Possibly the rainy-season form of the following species.

35. *Melanitis zitenius*, Herbst.

Tilin, November to May. The commonest *Melanitis* met with.

36. *Elymnias undularis*, Drury.

Pauk to Tilin, October and November; Tilin, November to May.

37. *Discophora spiloptera*, de Nicéville and Möller.

Tilin, March and April. Five males, four females. The males are not quite typical, as they have the middle row of spots on forewing blue, not yellow.

38. *Ergolis merione*, Cramer.

Tilin, December to May.

39. *Ergolis ariadne*, Linnæus.

Tilin, January. A single specimen.

40. *Cupha erymanthis*, Drury.

Tilin, December to May.

41. *Atella sinha*, Kollar.

Tilin, March; Choungkwa, May.

42. *Atella phalantha*, Drury.

Pokoko, September; Pauk to Tilin, November; Tilin, December to May.

43. *Cethosia cyane*, Drury.

Tilin, December. A single male.

44. *Apatura namouna*, Doubleday.

Six males on 30th May at Choungkwa.

45. *Apatura parysatis*, Westwood.

A single male at Tilin, early in December.

46. *Precis iphita*, Cramer.

Pauk to Tilin, November; Tilin, December to May.

47. *Junonia asterie*, Linnæus.

Tilin, March to May. One of the specimens taken in March is intermediate between *almana* and *asterie*, the shape of the wings being that of the latter species, while on the underside the ocelli are minute and all the markings indistinct.

48. *Junonia almana*, Linnæus.

Tilin, November to April.

49. *Junonia atlites*, Linnæus.

Tilin, December to May.

50. *Junonia lemonias*, Linnæus.

Pokoko, Pauk, September; Pauk to Tilin, November; Tilin, December to May.

51. *Junonia hierta*, Fabricius.

Pauk to Tilin, November; Tilin, December to May.

52. *Junonia orithyia*, Linnæus.

Tilin, March.

53. *Neptis hordonia*, Stoll.

Typical: Pauk, September; Pauk to Tilin, October, November; Tilin, December, and single specimens in February and March. Transitional to *plagiosa*: Pauk to Tilin, November; Tilin, December to April. *Plagiosa*: Tilin, March and April, and a single specimen in January. These last have all the yellow bands very broad, the dusky border on outer margin is obsolescent and only represented by a few dark spots, the yellow discoidal streak is not indented from above, and the extreme margin of hindwing is yellow towards anal angle. This form is very distinct from typical *hordonia*, but my series is bridged over by the forms separated above as "transitional." It will be noticed that only two typical *hordonia* were obtained after December, and only one typical *plagiosa* before March, the intermediate forms occurring from November to April.

The above remarks are based on about forty specimens.

54. *Neptis sattanga*, Moore.

Pauk to Tilin, November; Tilin, January to April. Varies considerably in the prominence of the markings on the underside, those caught in November being much more strongly marked than those caught later.

55. *Neptis tiga*, Moore.

A few specimens caught in company with preceding, which I believe to be the same species, the only point of distinction being that the present species has a yellow marginal line often very faint, on upperside of hindwing, which is wanting in *N. sattanga*.

56. *Neptis miah*, Moore.

Pauk to Tilin, October, November; Tilin, March. Five specimens.

57. *Neptis viraja*, Moore.

Tilin, March, April. Three specimens, all smaller than those in my collection from South India.

58. *Neptis burmana*, de Nicéville.

Tilin, February to April. A few specimens. The second submarginal line on underside of hindwings is very faint, but it can be distinguished from all allied species by the markings of the upperside.

59. *Neptis varmona*, Moore.

Pauk, September; Pauk and Tilin, November. Also two specimens transitional to *kamarupa*, Pauk and Tilin, November.

60. *Neptis kamarupa*, Moore.

Tilin, January to May. Almost certainly the dry-season form of *varmona*.

61. *Neptis eurymene*, Butler.

Tilin, April, May. What I separate as this species is similar to *kamarupa*, but is considerably larger than either it or *varmona*, and has all the white markings much larger and more prominent. It may also be a seasonal form of *varmona*, but I am inclined to consider it distinct, as I have never met with it except in Burma.

62. *Neptis astola*, Moore.

Pauk to Tilin, October and November; Tilin, March and April.

63. *Neptis khasiana*, Moore.
Tilin, December to April. Not common.

64. *Neptis soma*, Moore.
Tilin, December to April.

65. *Neptis adipala*, Moore.
Pauk to Tilin, November; Tilin, December to May. Both this and the preceding species frequently have the streak in cell undivided on the underside.

66. *Neptis nandina*, Moore.
Tilin, April.

67. *Neptis ophiana*, Moore.
Pauk to Tilin, October and November; Tilin, December to May. The specimens caught from November to February are dark brownish-ferruginous on the underside, with edges of markings blurred, those caught later are bright ochreous with sharply-defined markings. A single specimen obtained answers to the description of *N. martabana*, but it is almost without doubt a slight variety of *N. ophiana*.

68. *Hypolimnas bolina*, Linnæus.
Pokoko, September and October; Pauk, September; Tilin, December to May.

69. *Hypolimnas misippus*, Linnæus.
Pokoko, October; Tilin, December. A rare species in Burma.

70. *Parthenos gambrisius*, Fabricius.
Tilin, May. One very battered specimen of the variety *lilacinus*.

71. *Lebadea ismene*, Doubleday and Hewitson.
Pauk to Tilin, October; Tilin, December to May. All my specimens seem to approach *attenuata* in the breadth of the white band, with the exception of a single specimen caught in October which is typicial *ismene*.

72. *Limenitis procris*, Cramer.
Tilin, February to April.

73. *Athyma perius*, Linnæus.
Pauk to Tilin, November ; Tilin, December to April. Not common.

74. *Athyma pravara*, Moore.
Tilin, March. A single specimen.

75. *Athyma mahesa*, Moore.
Tilin, March. A single specimen.

76. *Athyma selenophora*, Kollar.
Pauk to Tilin, October; Tilin, November to March. Numerous males and one female. The commonest *Athyma* that occurred.

77. *Symphædra dirtæa*, Fabricius.
Pauk to Tilin, November; Tilin, February to May. Common.

78. *Euthalia derma*, Kollar.
Pauk to Tilin, November; Tilin, January to May. Occurred commonly, but usually in very bad condition; the spring brood appeared in March. All specimens are of a much more olive-brown than Distant's* figure, but not green like *evelina*.

79. *Euthalia lepidea*, Butler.
Tilin, November to May.

80. *Euthalia appiades*, Ménétriés.
Tilin, March. Two males, one female; the latter differs from typical females of *appiades* in having both bands on both wings straight; typically the inner band is conspicuously lunulate on forewing and less so on hindwing, the outer band alone being straight.

81. *Euthalia jahnu*, Moore.
Tilin, December to March. Seven males, two females.

82. *Euthalia garuda*, Moore.
Tilin, February to May.

83. *Euthalia lubentina*, Cramer.
Tilin, February and May. Two males, one female.

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* Rhop. Malay., pl. xix., fig. 4.

84. *Vanessa canace*, Linnæus.

Pauk to Tilin, November; Tilin, November to May. Not common. Found flying singly up and down the stony beds of streams.

85. *Symbrenthia hippoclus*, Cramer.

Tilin, February, March. Two males, two females. One of the latter (taken in February) has the bands on the upperside narrower and the submarginal band of hindwing dotted with black, so is presumably referable to *S. khasiana*, Moore, a doubtfully distinct species.

86. *Rhinopalpa vasuki*, Doherty.

Pauk to Tilin, November; Tilin, December to May. Very common in March, but specimens though fresh were terribly battered, I caught dozens, but only got six worth killing and keeping, and none of these are quite perfect.

87. *Cyrestis thyodamas*, Boisduval.

Tilin, November. A single specimen.

"88. *Cyrestis rahria*, Moore.

Pauk to Tilin, November to March. Not uncommon. It varies considerably in size and depth of coloration.

89. *Kallima limborgii*, Moore.

Pauk, October; Tilin, November. One male, one female. These specimens differ from a single male I have taken in Upper Tenasserim, in having the yellow band paler and of less extent, and in being much smaller, ♂ 3·3, ♀ 3·6 inches as against 3·9 inches. A female of *inachis* in my collection from Darjiling measures 4·7 inches.

90. *Charaxes eudamippus*, Doubleday.

Tilin, February. Two specimens.

91. *Charaxes athamas*, Drury.

Pauk to Tilin, November; Tilin, February, March; Choungkwa, May. There are two distinct forms of what I recognise as this species, both of which have a greenish-yellow fascia of varying width on the upperside, but differing considerably on the underside; one form having a greenish fascia and the other a golden-yellow fascia narrowly outlined with white. Both these forms have one large and two small subapical spots.

92. *Charaxes arja*, Felder.

Pauk to Tilin, November; Tilin, December to March; Choungkwa, May. What I separate as this species was decidedly commoner than the preceding. It also varies considerably in the breadth of the fascia, which in very pale bluish-green, almost white, without a trace of yellow, both above and below. It has one large subapical spot and occasionally another near the apex, but the latter is always minute and generally absent, the submarginal row of spots on underside of hindwing is inconspicuous.

93. *Charaxes fabius*, Fabricius.

Pauk to Tilin, October; Tilin, March.

94. *Charaxes harpax*, Felder.

Pauk to Tilin, October; Tilin, March and November; Choungkwa, May. Four specimens only; they all differ from one another, and none agree exactly with any of the descriptions in "Butterflies of India."

95. *Charaxes hierax*, Felder.

Pauk to Tilin, October. A single male agreeing best with this species.

*96. *Charaxes bernardus*, Fabricius.

I have twenty-two specimens of this group taken at Choungkwa on the 29th and 30th May. They vary considerably in the prominence and purity of the discal white band, in the number of fulvous spots on the black margin of the forewing, and in the black submarginal border of the hindwing, which in some specimens is almost continuous, and in others broken up into spots and almost obsolete at the anal angle. I have submitted six specimens to Mr. de Nicéville, and he informs me that none of them agree with any of the described forms, and might equally well be described as six new species.

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* Rhop, Malay, pl. xix. fig. 4,

LEMONIIDÆ.

97. *Libythea myrrha*, Godart.
Tilin, December. A single specimen.

98. *Libythea libera*, de Nicéville.
Tilin, March. A single specimen which I have compared with the type in the Phayre Museum, Rangoon, with which it is absolutely identical.

99. *Abisara neophron*, Hewitson.
Tilin, March. A single specimen.

100. *Abisara chela*, de Nicéville.
Pauk to Tilin, November. A single specimen.

101. *Abisara echerius*, Stoll.
Pauk to Tilin, November; Tilin, March to May. Numerous specimens, some quite indistinguishable from specimens of *A. suffusa* in my collection from the Nilgiris and Mysore, though the great bulk are of the form *angulata* more or less typical.

LYCÆNIDÆ.

102. *Gerydus symethus*, Cramer.
Tilin, March. A few specimens.

103. *Gerydus biggsii*, Distant.
Tilin, March, April. Three specimens. This species is very close to the preceding.

104. *Gerydus boisduvali*, Moore.
Pauk to Tilin, November; Tilin, March. Not uncommon, but local.

105. *Paragerydus horsfieldi*, Moore.
Tilin, November and December. Two specimens.

106. *Poritia hewitsoni*, Moore.
Tilin, March. A single male.

107. *Pithecops hylax*, Fabricius.
Pauk to Tilin, November; Tilin, November to May. Fairly common.

108. *Neopithecops zalmora*, Butler.
Tilin, November to April. Four specimens.

109. *Taraka hamada*, Druce.
Tilin, March and May. Two specimens.

110. *Megisba malaya*, Horsfield.
Tilin, March. A single specimen of the tailed form.

111. *Chilades laius*, Cramer.
Pokoko, September. A single male of the rainy-season form.

112. *Chilades trochilus*, Freyer
Pokoko, September; Pauk to Tilin, November; Tilin, March, April. Seven specimens, none of which have any yellow on upperside of hindwing, and which are all very small as compared with a single Indian female in my collection from Quetta, but agreeing with other specimens from various localities in Burma.

113. *Cyaniris puspa*, Horsfield.
Pauk to Tilin, October, and November; Tilin, December to May. Three males, four females.

114. *Cyaniris placida*, de Nicéville.
Tilin, March. Two females.

115. *Cyaniris jynteana*, de Nicéville.
Tilin, May. A single female.

116. *Zizera lysimon*, Hübner.
Tilin, April. Only a single male caught, but occurs commonly.

117. *Zizera gaika*, Trimen.
Tilin, April. Also occurs commonly.

118. *Zizera otis*, Fabricius.
Tilin, November to April. Differs slightly in markings from Indian specimens.

119. *Azanus gamra*, Lederer.
Pokoko, September. A single female.

120. *Azanus ubaldus* (?), Cramer.
A single male caught at Tilin in April, is referred to this species by Mr. de Nicéville pending receipt of further specimens. It differs from typical Indian specimens in being considerably larger, and in having a narrow sharply defined dark border to forewing on upperside. On underside it is more strongly marked than any of my

Indian specimens of *ubaldus*, and the pattern of the markings is slightly different. No species of *Azanus* has previously been recorded from Burma, nor are there any in the Phayre Museum, Rangoon, but it is probable that at least two species occur not uncommonly in the "dry zone" from Thayetmyo north, which has never been properly worked.

121. *Lycænesthes emolus*, Godart.

Tilin, December to May; Choungkwa, May. Males very common, females rare.

122. *Lycænesthes lycænina*, Felder.

Pauk, September; Tilin, November. Two males, one female.

123. *Talicada nyseus*, Guérin.

Pauk, October, November ; Tilin, December to April Differ from Indian specimens in my collection from Ganjam, the Nilgiris, and Mysore, in the small size of the marginal and submarginal series of white spots on the underside of the forewing, and of the submarginal white spots on underside of hindwing. The black spots on underside of hindwing vary as usual from the full complement of thirteen to as few as six, those caught in March and April having almost invariably thirteen. Common, but very local, being found at Pauk on one small hill, and at Tilin being confined within the limits of a single pagoda wall.

124. *Everes argiades*, Pallas.

Tilin, February and April. Two males, one female. Usually a rare species in Burmah, though I have met with it in Tounghoo lately in considerable numbers.

125. *Nacaduba cœlestis*, de Nicéville.

Pauk to Tilin, October; Pauk, September; Tilin, March. Three males.

126. *Nacaduba ardates*, Moore.

With tails: Tilin, December to May. Four males, four females. Without tails; Pauk, September; Tilin, November to April. Nine males.

127. *Nacaduba dana*, de Nicéville.

Pauk to Tilin, November; Tilin, December and March. Four males.

*128. *Nacaduba hampsoni*, de Nicéville.

Tilin, April and May. Two males. This is a very distinct species, on the upperside it is a violet-blue with a brilliant gloss. The markings on underside very prominent.

129. *Jamides bochus*, Cramer.

Pauk to Tilin, November; Tilin, November to May. Males and females equally common; hardly any difference between dry- and rainy-season forms.

130. *Lampides elpis*, Godart.

Pauk to Tilin, November; Tilin, March and April.

131. *Lampides coruscans*, Moore.

Tilin, February and March. Two males of this species or variety.

132. *Lampides ælianus*, Fabricius.

Pauk to Tilin, November; Tilin, March and May. Also one male and one female at Tilin in March which seem referable to *L. pura* of Moore.

133. *Catochrysops strabo*, Fabricius.

Pokoko, September; Pauk to Tilin, November; Tilin, November to May.

134. *Catochrysops lithargyria*, Moore.

Tilin, March. Two males.

135. *Catochrysops pandava*, Horsfield.

Dry-season form: Pauk to Tilin, November; Tilin, December and May. Rainy-season form: Pauk to Tilin, November; Tilin, April and May; also several intermediate varieties during November. These two forms occurred together, and do not seem to be very closely restricted to the dry- and rainy-seasons, respectively, though undoubtedly of the same species.

136. *Tarucus theophrastus*, Fabricius.

Pokoko, September; Tilin, May. Three specimens. These specimens agree exactly with the detailed description of this species in "Butterflies of India," and have the underside *brown*. They also agree with specimens in my collection from Ahmednagar, Deccan.

Nara, Kollar, Pokoko, September; Gangaw, February. Two females. These specimens differ from the preceding in having the markings on the underside *black*, and are therefore apparently *nara*; they also differ slightly in the pattern of the hindwing on the underside. I have since (in August) caught four specimens at Myingyan which agree in markings with the two Yaw females.

137. *Tarucus plinius*, Fabricius.

Pokoko, September, October; Tilin, November to May.

138. *Castalius rosimon*, Fabricius.

Pauk to Tilin, September and November; Tilin, December to May.

139. *Castalius ethion*, Doubleday and Hewitson.

Pauk to Tilin, November; Tilin, January to March. Even commoner than *C. rosimon*.

140. *Castalius decidea*, Hewitson.

Pauk to Tilin, November; Tilin, January to April. Seven specimens all of the form *interruptus*.

141. *Polyommatus bœticus*, Linnæus.

Tilin, December. A rare species in Burma except at high elevations.

142. *Amblypodia anita*, Hewitson.

Pauk, September; Pauk to Tilin, November; Tilin, December to May. Numerous males and females, all purple.

143. *Iraota timoleon*, Stoll.

Tilin, May. A single female.

144. *Surendra quercetorum*, Moore.

Tilin, April; Choungkwa, May. Two females.

*145. *Apporasa atkinsoni*, Hewitson.

Tilin, March to May. Nine specimens. They settle on trunks of trees, the bark of which agrees exactly with the coloration of their underside.

146. *Arhopala centaurus*, Fabricius.

Tilin, February to May. Very common. Also numerous females of a closely allied species, which differs from typical *centaurus*, in having on the upperside the blue of the hindwing confined to a spot at base, and on the underside in having the fourth spot of the discal band moved outwards, and in having a large dark spot from angle of submedium interspace, extending towards the outer margin to as far as the discal band. On the underside this species is nearest to *amantes*, but has no anal lobe. As none of my specimens are in good condition this species will not be described by Mr. de Nicéville.

147. *Arhopala silhetensis*, Hewitson.
Tilin, April. A single worn male.

148. *Arhopala amatrix*, de Nicéville.
Tilin, May; Loungat, May. Allied to *A. amantes*, from which it differs in both sexes in having a broader black margin to both wings. This species will shortly be described by Mr. de Nicéville.

149. *Arhopala abseus*, Hewitson.
Tilin, March. A single specimen.

150. *Arhopala atrax*, Hewitson.
Pauk to Tilin, November; Tilin, November and May; Choungkwa, May. Numerous specimens.

151. *Arhopala rama*, Kollar.
Tilin, March to May. Three males, one female.

152. *Arhopala alemon*, de Nicéville.
Tilin, March, April, May. Very numerous specimens. This species, which is allied to the preceding, will shortly be described by Mr. de Nicéville.

153. *Arhopala adriana*, de Nicéville.
Tilin, March. A single male.

154. *Arhopala helenore*, Doherty.
Tilin, March. A single male.

155. *Arhopala tounguva*, Grose-Smith.
Tilin, March; Choungkwa, May. One male, four females. The female is of a much brighter blue than the male, which is almost purple.

156. *Acesina aberrans*, de Nicéville.
Tilin, December to May. Occurred very commonly in company with the following species, but with the exception of the spring brood which appeared in May, was nearly invariably in bad condition.

157. *Acesina arisba*, de Nicéville.
Tilin, January to May. Fairly common. Will shortly be described by Mr. de Nicéville.

158. *Curetis dentata*, Moore.
Tilin, January to May. Eleven males, one female. What I separate as this species has the disco-cellulars marked with black, and a black patch from base of hindwing. Red area large. The female has white patches on the upperside of similar shape and extent to the red patches of the male.

159. *Curetis malayica*, Felder.
Pauk to Tilin, October; Tilin, January to May; Choungkwa, May. Six males, four females. This form has the red area of similar extent to the preceding, and also has the disco-cellulars marked with black, but has no basal black patch on hindwing. The female has the forewing as in the male, but white, with slightly wider borders; on hindwing it only has a narrow white band extending from middle of costa to half way across disc.

160. *Ilerda epicles*, Godart.
Tilin, November and March. Choungkwa, May. Five males, one female.

161. *Camena cleobis*, Godart.
Tilin, April. A single pair.

162. *Aphnæus syama*, Horsfield.
Pauk to Tilin, November; Tilin, May. Occurred commonly.

163. *Aphnæus lohita*, Horsfield.
Tilin, February to May. Not so common as preceding species.

164. *Tajuria indra*, Moore.
Tilin, March, April. Three males.

165. *Tajuria jangala*, Horsfield.
Tilin, February. A single specimen.

166. *Hypolycæna erylus*, Godart.
Pauk, September; Tilin, December to May.

167. *Chliaria othona*, Hewitson.
Tilin, November to May. Seven males.

168. *Zeltus etolus*, Fabricius.
Tilin, March. A single male.

169. *Ticherra acte*, Moore.
Tilin, November, December. Two females, both of the rainy-season form.

170. *Cheritra freja*, Horsfield.
Pauk to Tilin, November; November to April.

171. *Drupadia boisduvalii*, Moore.
Tilin, January. A single female.

172. *Loxura atymnus*, Cramer.
Pauk to Tilin, November; Tilin, March to May.

173. *Zinaspa distorta*, de Nicéville.
Tilin, March, April. A single pair of what I believe to be this species.

174. *Rapala schistacea*, Moore.
Pauk, September; Tilin, December to May.

175. *Rapala orseis*, Hewitson.
Pauk, September; Tilin, December to May.

176. *Rapala petosiris*, Hewitson.
Tilin, March to May.

177. *Rapala melampus*, Cramer.
Pauk, October; Tilin, March to May. One male, seven females.

178. *Rapala jarbas*, Fabricius.
Pauk, September, October; Pauk to Tilin, November; Tilin, December to March; Choungkwa, May. The occurrence of this and the preceding species together is worthy of note, as Mr. de Nicéville remarks in "*Butterflies of India*" that he has no record of both species occurring

in the same locality. The present species is the typical Burman one, and occurs commonly throughout Burma. *R. melampus* has not previously been recorded east of Calcutta.

PAPILIONIDÆ.

Pierinæ.

179. *Nychitona xiphia*, Fabricius.
Pauk, November; Tilin, November to May.

180. *Delias hierte*, var. *indica*, Wallace.
Tilin, March.

181. *Delias descombesi*, Hewitson.
Tilin, December, May. Two males.

182. *Delias agostina*, Hewitson.
Tilin, November and March. A single pair.

183. *Delias pyramus*, Wallace.
Tilin, December. A single specimen.

184. *Delias pasithöe*, Linnæus.
Tilin, December to May. Fairly common.

185. *Catopsilia catilla*, Cramer.
Pauk to Tilin, November; Tilin, March.

186. *Catopsilia crocale*, Cramer.
Pokoko, September, October; Pauk, September.

187. *Catopsilia pyranthe*, Linnæus.
Pokoko, September, October; Tilin, May. Probably the wet-season form of the next species.

188. *Catopsilia gnoma*, Fabricius.
Pauk to Tilin, November; Tilin, December.

189. *Mancipium canidia*, Sparrman.
Tilin, end of December to beginning of February.

190. *Terias harina*. Horsfield.
Pauk to Tilin, November. A single specimen.

191. *Terias læta*, Boisduval.
Pauk to Tilin, November; Tilin, December, April.

192. *Terias hecabe*, Linnæus.
Typical: Pokoko, Pauk, September; Tilin, November to May.

Æsiope : Pauk to Tilin, November; Tilin, December to May.

Purreea : Tilin, December to February.

193. *Terias sari*, Horsfield.

Pauk to Tilin, November ; Tilin, November to February.

194. *Terias venata*, Moore.

Pauk, November. A single specimen.

195. *Ixias pyrene*, Linnæus.

I obtained altogether fifty-six specimens, which, though probably all of the same species, were of four distinct forms easily separable by the markings on the underside of the hindwing.

Variety a : Ten specimens of a large form, with the underside clear yellow moderately striated with brown; and with three to six brown ocelli on hindwing. This form occurred at Tilin in December, January and March, being commonest in March.

Variety b : Seventeen specimens of a much smaller form, also with clear yellow underside, with few striations and three or four brown ocelli with white centres. This form occurred at Pokoko in September and October, and at Tilin in April, being commonest in the former months.

Variety c : Twelve specimens of a form of the same size as the last, also with a clear yellow underside, but absolutely without striations, and with no trace of ocelli. This form occurred at Pokoko in September and October, at Pauk in September, and at Tilin in April and May.

Variety d: Seventeen specimens of a form with an orange-yellow underside densely striated, and with a varying number of ocelli. This form occurred at Tilin in January and February only. Varieties *a* and *d* are presumably dry-season forms and *b* and *c* rainy-season forms. If that is the case the dry-season forms have the underside of hindwing more densely striated than the rainy-season ones.

196. *Catophaga libythea*, Fabricius.

Tilin, January. Five males which Mr. de Nicéville considers may possibly be the dry-season form of this species.

197. *Catophaga paulina*, Cramer.
Loungat, May. One female.

198. *Hiposcritia lalage*, Doubleday.
Tilin, December. One female doubtfully referred to this species by Mr. de Nicéville.

199. *Huphina nama*, Doubleday.
Pauk to Tilin, November; Tilin, December to February. Five specimens only.

200. *Huphina phryne*, Fabricius.
Pokoko, September and October; Pauk to Tilin, November. Numerous specimens of the Burmese form of this ubiquitous species.

201. *Huphina lea*, Doubleday.
Pokoko, September. One female.

202. *Appias zelmira*, Cramer.
Pauk, September and October; Pokoko, September; Tilin, December. Very numerous specimens.

203. *Hebomoia glaucippe*, Linnæus.
Pauk, September; Pauk and Tilin, October, November; Tilin, November to May. Swarmed in November.

204. *Nepheronea gæa*, Felder.
Pauk and Tilin, November; Tilin, November to April.

PAPILIONINÆ.

205. *Ornithoptera rhadamanthus*, Boisduval.
Pokoko, October; Pauk, November; Tilin, December to March.

206. *Papilio androgeus*, Cramer.
Form *cilix*: Tilin, March. One male.
Form *mestor*: Tilin, November and March. One male, two females.

207. *Papilio polytes*, Linnæus.
Pauk, September; Pokoko, October; Pauk to Tilin, November; Tilin, December to May.

208. *Papilio aristolochiæ*, Fabricius.
Pauk, September; Pokoko, October; Pauk to Tilin, November; Tilin, December to May.

209. *Papilio helenus*, Linnæus.
Choungkwa, May. A single specimen very much worn.

210. *Papilio onpape*, Moore.
Tilin, March. Two specimens.

211. *Papilio dissimilis*, Linnæus.
Tilin, March to May; Choungkwa, May.

212. *Papilio nomius*, Esper.
Tilin, March to May.

213. *Papilio paris*, Linnæus.
Tilin, March; Choungkwa, May. Two specimens.

214. *Papilio erithronius*, Cramer.
Pokoko, October; Pauk, September; Pauk to Tilin, November; Tilin, December to May.

215. *Papilio sarpedon*, Linnæus.
Choungkwa, May. A single specimen.

216. *Papilio eurypylus*, Linnæus.
Tilin, February. A single specimen.

217. *Papilio mecisteus*, Distant.
Choungkwa, May. A single specimen. The scarcity of *Papilios* in this district is not a little remarkable.

HESPERIIDÆ.

218. *Badamia exclamationis*, Fabricius.
Pokoko, October; Pauk, November; Tilin, March, April, not very common in Burma.

219. *Choaspes harisa*, Moore.
Tilin, November, March.

220. *Choaspes amara*, Moore.
Tilin, November. A single male.

221. *Ismene mahintha*, Moore.
Pauk to Tilin, November. Comes to flowers of varieties of pumpkin at daybreak and dusk.

222. *Parata chromus*, Cramer.
Tilin, March and May.

223. *Matapa aria*, Moore.
Pauk to Tilin, November; Tilin, December to May. Occurs commonly.

224. *Matapa druna*, Moore.
Tilin, March. Two males.

225. *Matapa sasivarna*, Moore.
Tilin, March. A single male.

226. *Matapa shalgrama*, de Nicéville.
Tilin, March Two females.

227. *Baoris oceia*, Hewitson.
Pauk to Tilin, November; Tilin, November to April. Nineteen males with from two to eight spots, usually seven or eight, the uppermost of the subapical ones being frequently wanting. The two cell-spots also were obsolete in nine specimens. Twelve females with from one to nine spots varying similarly to the males. In both sexes the two lower discal spots were present in all specimens with the exception of one female, in which the upper of these was wanting.

228. *Chapra mathias*, Fabricius.
Pokoko, September, October; Tilin, January, March.

229. *Chapra* sp.
Tilin, March. A single male. Readily distinguished from all described species of *Chapra* in having no white spots on underside of hindwing, but instead a discal series of four brown spots, though possibly a sport.

230. *Parnara mangala*, Moore.
Pauk, November. A single specimen.

231. *Parnara bada*, Moore.
Pokoko, September; Pauk, November; Tilin, November to April. Distinguished from preceding by having no spots in cell, and by having the spots on underside of hindwing smaller but arranged in line and not in a semicircle as in *P. colaca*.

232. *Parnara colaca*, Moore.
Pokoko, September, October; Pauk, November; Tilin, January, March. Twelve specimens. This species as I identify it has seven white spots on forewing, three subapical, three discal, of which the lowest is the largest, and one on submedian vein; it also usually has an additional

minute spot at the end of the cell. On the upperside of the hindwing it almost invariably has a single minute spot. On the underside, the apex and costal margin of forewing and whole of hindwing is suffused with greenish. On the forewing three white spots are as on the upperside, on the hindwing there are four white spots, of which the second upper is minute and occasionally absent. I also have this species from Mysore.

233. *Parnara bevani*, Moore.

Tilin, March, April, May. Seven specimens. Very similar to *P. colaca*, but slightly smaller and with differently shaped wings, the forewing being shorter and broader. The spots on the forewing are smaller, the upper discal one and the one on submedian vein being frequently absent. The underside is similar to that of *P. colaca*, but with spots less prominent. I also have this species from the Nilgiris and Toungoo, Burma.

234. *Parnara* sp.

Tilin, January. A single specimen. Allied to *P. colaca*. Differing from it in having only six spots on forewing, the one on submedian vein, which is invariably present in *colaca*, being wanting. No spot in cell. Hindwing unmarked above and below. Base of the forewing and almost the whole of the hindwing clothed with long greenish hairs on upperside. On the underside the apex of the forewing and whole of the hindwing are greenish.

235. *Parnara assamensis*, Wood-Mason and de Nicéville.

Pauk to Tilin, November. A single male.

236. *Parnara toona*, Moore.

Tilin, April. A single specimen.

237. *Parnara austeni*, Moore.

Tilin, April. Two specimens. I am unable to distinguished this species from *P. cahira* or *P. farri*.

238. *Parnara semamora*, Moore.

Pauk to Tilin, November; Tilin March, April. Common.

239. *Parnara watsonii*, de Nicéville.

Pauk, September and November; Pauk to Tilin, October, November; Tilin, November to May. Very common.

240. *Suastus gremius*, Fabricius.

Tilin, December to May. Loungat, May.

241. *Sarangesa dasahara*, Moore.

Pauk, November; Tilin, November to May.

242. *Telicota augias*, Linnæus.

Pokoko, October; Pauk, November. Two males.

243. *Telicota bambusæ*, Moore.

Tilin, February. Three males.

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244. *Padraona gola*, Moore.

Tilin, November. A single specimen.

245. *Padraona nigrolimbata*, Snellen.

Pauk, September, November. Two specimens. This is a well-marked, and easily-distinguished species; it is the smallest of the genus, being about the size of *A. maro*.

246. *Padraona dara*, Kollar.

Pauk to Tilin, November; Tilin, November, December. Numerous specimens which I doubtfully assign to the species.

247. *Padraona* sp.

Pauk to Tilin, November; Tilin, March, April. Three specimens which I am unable to identify.

248. *Ampittia maro*, Fabricius.

Tilin, November; Gangaw, February. One male, one female.

249. *Taractrocera mævius*, Fabricius.

Pauk, November; Tilin, May.

250. *Cupitha purreea*, Moore.

Tilin, March, April. A few specimens.

251. *Halpe beturia*, Hewitson.

Pauk to Tilin, November; Tilin, November, March.

252. *Halpe meiktila*, de Nicéville.

Tilin, March. A single specimen. This species will shortly be described by Mr. de Nicéville.

253. *Isoteinon subtestaceus*, Moore.

Tilin, March. Three specimens.

254. *Isoteinon masoni*, Moore.
Tilin, March. Four specimens.

255. *Isoteinon satwa*, de Nicéville.
Tilin, March, April. Three specimens.

256. *Isoteinon cephala*, Hewitson.
Tilin, December to May. Very common.

257. *Isoteinon flavipennis*, de Nicéville.
Tilin, March. Three specimens.

258. *Satarupa bhagava*, Moore.
Tilin, March to May. Common.

259. *Satarupa phisara*, Moore.
Tilin, March. Two specimens.

260. *Tagiades ravi*, Moore.
Tilin, December and March. Seven specimens.

261. *Tagiades khasiana*, Moore.
Tilin, November, December and January. Five specimens.

262. *Tagiades menaka*, Moore.
Tilin, March. A few specimens.

263. *Abaratha syrichthus*, Felder.
Loungat, May. Three specimens.

264. *Abaratha*, n. sp.
Tilin, March. A single specimen. Will shortly be described by Mr. de Nicéville.

265. *Hyarotis adrastus*, Fabricius.
Tilin, March.

266. *Coladenia dan*, Fabricius.
Tilin, November to April. Common.

267. *Coladenia indrani*, Moore.
Tilin, April. A single specimen.

268. *Udaspes folus*, Cramer.
Pauk, September; Tilin, March.

269. *Celænorrhinus leucocera*, Kollar.
Tilin, March, April; Choungkwa, May. Very common.

270. *Notocrypta restricta*, Moore.
Tilin, November to March. Very common.

271. *Tapena thwaitesi*, Moore.
Tilin, May. A single specimen.

272. *Tapena agni*, de Nicéville.
Tilin, March. A single specimen.

273. *Astictopterus olivascens*, Moore.
Tilin, April. Two specimens.

274. *Astictopterus salsala*, Moore.
Pauk to Tilin, November; Tilin, December to May.

275. *Kerana aurivittata*, Moore.
Tilin, November to April. Common in company with *C. leucocera*, both species frequently caught together sitting on the underside of the same leaf.

276. *Hesperia zebra*, Butler.
Pauk, September, November; Tilin, March. Three specimens.

THE GENUS *CHLOROPSIS.*

BY E. C. S. BAKER.

(*Read at the Meeting of the Bombay Natural History Society on 31st March, 1891.*)

It is with a thorough sense of my inability to treat the subject as it deserves, that I venture to write the following remarks on the place which the genus *Chloropsis* should hold in the Avifauna, but at the same time I trust that it will induce others more competent to come forward and either correct or support the views taken by myself.

In the first place, I will quote Oates' words on the subject in full, and will then take them in detail. The paras. will be found in the "*Fauna of British India Birds*," Vol. I., p. 234 :—

"*Chloropsis* is always placed amongst the bulbuls, but with the exception of the very short tarsi, there is nothing in common between the two to point to any close relationship.

"In this genus the bill is slender and curved, and about as long as the head; the tip is notched, and the nostrils are oval; the rictal bristles are weak; the frontal feathers are advanced up to the nostrils; the head is not crested; the wing is rounded, and the tail is short and square; the tarsi are very short, shorter than the middle toe without the claw."

Taking these alleged differences in detail—

"*Bill slender and curved.*" Can the fact of the bill being slender be advanced as a reason for dividing this bird from the *Brachypodinæ*, a Sub-family, which admittedly includes birds having such opposite forms of bill as are exhibited in the two birds, *Hypsipetes* and *Spizixus?* Which, I ask, shows the greater difference, a comparison between the mandibles of these two genera, or between those of *Chloropsis* and the former?

As regards the bill being curved, the *majority* of the bulbuls possess this attribute strongly, all more or less, "*and about as long as the head.*" Here, again, we may refer to *Spizixus* as having about the shortest bill of any bulbul, scarcely exceeding one-third the length of the head; in *Alucurus* the bill is a little under one-half the length, in many bulbuls it is about, or rather more than half the length of the head; in *Iole* we find that is equal to three-quarters, whilst in *Hypsipetes* the length of the bill is the same as the head. So that in this genus the proportionate length of the bill is the same as in *Chloropsis.*

"*The bill is notched.*" This is also a characteristic of the bills of Oates' Sub-fam. *Brachypodinæ.*

"*The nostrils are oval.*" Again the same as in that Sub-family.

"*The rictal bristles are weak.*" This is certainly a feature which is rare in the Sub-family as curtailed by him, but even in this case there are many degrees of strength and length. Thus in *Hypsipetes* the rictal bristles are decidedly less developed than in many of the other genera, and again there is a vast difference in the stoutness of those found in the birds *Alucurus* and *Hemixus.*

"*The frontal feathers are advanced up to the nostrils.* In *Spizixus* we actually find that they not only come up to the nostrils but assume an enlarged character, and they are called by Oates "plumelets," these same plumelets partially overhanging and obscuring the nostrils.

"*The head is not crested.*" Nor have all the bulbuls crested heads, as for instance *Alophooxus*, etc. Indeed, in the Sub-family the form of the head feathers range from such as are found in the full-crested birds *Hypsipetes, Spizixus,* and others through *Molpastes* (see Oates' sketch of *M. leucotes* and others of this genus) to that remarkable bird, *Trachycomus ochrocephalus*.

"*The wing is rounded.*" A characteristic of the wing of the *Brachypodinæ* in common with the other members of the *Crateropodidæ*.

"*The tail is short and square.*" This again is a point to which not the slightest importance can, to my mind, be given, in a group of birds in which the type of tail graduates from the long-forked tail of *Hypsipetes* to the short rounded one of *Micropus*.

"*Tarsi are very short.*" An extremely strong characteristic of the Sub-family *Brachypodinæ*.

The absence of the nuchal hairs is not important, as they are not always present in the members of the Sub-family, and again are present in others separated by Oates from it, as in *Irene*.

The main difference therefore lies in the fact that the sexes are differently coloured, and to those who deem this in itself a sufficient reason for the removal of the genus from the Sub-family *Brachypodinæ*, I would suggest that these birds be placed by themselves in a separate Sub-family coming *after* the bulbuls and leading into *Irene* and *Oriolus*.

Having thus, I fear but indifferently, shown the weakness of the reasons for separating this bird from the Sub-family, I may now state reasons, which I consider to be very strong, why they should be retained in it.

First, as regards food and their manner of feeding. In this I think nothing can be advanced as a reason for separating them, whereas the fact that many bulbuls and *Chloropsis* feed on the same food and feed in the same manner, is evidence to a certain extent showing that they should be placed in the same group. Some time ago, in an article to the *Asian* on some of the *Chloropsis*, I mentioned the fact that I had seen them feeding on white ants which they captured on the wing, and at the same time I mentioned the fact that I had also noticed this trait in *Molpastes* and in *Otocompsa* (both *emeria* and *flaviventris*).

Then their flight is that of a bulbul's, nearly approaching that of *Otocompsa*, but less jerky and perhaps quicker.

Voice.—It is quite true that in this respect there are certain differences, but to no greater extent than exist amongst bulbuls themselves.

Many of the notes are almost indistinguishable from the notes of *Otocompsa.* I have often listened to these birds when they have been feeding in company with *O. flaviventris,* and have noticed that certain of the lower notes used by them cannot be ascribed with certainty to either bird. Again, a harsh note that they often use when irritated is exactly like a common cry of *Hypsipetes concolor.* The song of the male is a most typical bulbul's. Another trait that they show in common with many bulbuls is their aptitude for imitation. I have frequently heard birds of this genus, more especially *aurifrons,* imitating the cries of Shrikes and other birds. That the common form of bulbuls do mimic other birds is a well known fact.

Sociability.—Oates states that these birds are to be found either singly or in pairs. With this statement I most emphatically disagree ; every year I see hundreds of these birds, and my experience tells me that throughout the cold season *Chloropsis aurifrons* and *hardwickii* always, and *jerdoni* generally, are to be found in flocks, these flocks being often of considerable size. Nor by this do I merely mean to say that many individuals are to be sometimes found feeding on the same tree, for should they be frightened away, they still keep together and do not disperse, as they would do had they no connection with one another. Again, I have repeatedly watched a flock of these birds for some length of time at a stretch, and can confidently assert that they keep together when on the wing, whilst outlying and straggling birds repeatedly call to and are answered by other members of the flock, which they always rejoin in a few minutes.

Nidification.—Here I think is most plainly shown the position of these birds amongst the Avifauna, showing the very strongest affinity to the bulbuls.

The nests.—I have seen many of *C. jerdoni, hardwickii,* and *aurifrons,* which are in every essential, almost, if not quite, indistinguishable from nests of *H. psaroides* and *concolor,* a few being of the same type as that of *Hemixos flavala.*

Like the nests of *Hypsipetes* those of *Chloropsis* are generally placed in some small horizontal fork of a branch of a high tree, and like them are, more often than not, placed at a considerable height from the ground, and close to the top or outside of the tree.

If the eggs are closely examined they too prove to be of typical bulbul's character; and I think that almost any one, not knowing what they were, would unhesitatingly declare them to belong to an individual of the Sub-fam. *Brachypodinæ.*

I have one clutch of eggs of *C. hardwickii* that can be matched by many eggs of *Hypsipetes concolor*, agreeing with them both in size and general colouring; another clutch of eggs (*C. aurifrons*) is very like some eggs of *Alucurus striatus* now in my possession, and like the latter eggs the markings are of a more decided brown tinge than is common amongst bulbuls' eggs.

In texture the eggs differ in no way from the common kinds of bulbuls' eggs, that is to say, they are fairly close-grained and smooth, showing little or no gloss, and are, in proportion to their size, rather fragile.

I have ventured these few notes, not for a moment under the impression that I am an authority on the subject, but because I have had, what I believe to be, very exceptionable opportunities of watching this genus in a state of nature, and because every trait that I have noticed leads me strongly to the belief that these birds are true bulbuls; whether worthy of a sub-family to themselves or not, I leave it for better ornithologists to determine.

I must also observe that I cannot help thinking, that it is both more natural and convenient to classify birds by their external characteristics taken in conjunction with their habits—nidification especially—than to assign them a place in a system worked out almost entirely on the internal structure of the bird. Again, the latter system entails immense extra labour, as in a dry skin the internal parts are wanting, and in dried, carbolized specimens, they are generally mutilated and incomplete, thus entailing the necessity of the ornithologist obtaining his own specimens for the work of classification, a matter not only of great difficulty, but often absolutely impossible.

In conclusion, I think I may say that as regards this genus in life, it shows stronger affinities to the Sub-fam. *Brachpodinæ* than to any other, that in its external characteristics many points confirm this connection, whereas they shew no *strong* reason for dividing them from the Sub-fam., with the one exception of the different coloration of the sexes.

A LIST OF THE ODORIFEROUS GRASSES OF INDIA, WITH A DESCRIPTION OF A NEW SPECIES OF *ANDROPOGON.*

By Mrs. J. C. Lisboa.

(*Read at the Society's Meeting on* 31*st March*, 1891.)

In my paper on the *Odoriferous Grasses of India and Ceylon*, read at the Society's Meeting held on the 7th August, 1889, I enumerated several *Andropogons* which are found growing wild or cultivated in different parts of India and Ceylon, and which yield aromatic oils and other scented products, illustrating my notes of some of the grasses therein mentioned, with drawings and specimens which were then available. Since then, specimens of all the known scented grasses of India have come to hand, some being kindly lent by Mr. Duthie of Saharanpore. These I have the pleasure of exhibiting here to-day, together with the description of a new species of *Andropogon* hitherto inedited. The following are the chief species of *Andropogons* enumerated by me in the aforesaid paper.

Andropogon Nardus, Linn. This magnificent tall grass is represented by several sub-species and varieties, some of which are confined to particular countries only, and their extreme forms differ considerably from one another, but are joined by intermediate ones. The beautiful plate in Dr. Trimen and in Bentley's work, *The Medicinal Plants*, refers, according to Professor Hackel, of Poltan, Hungary, to one of these.

The whole plant, (especially the leaves, when bruised,) is sweet-scented, and grows wild in Ceylon, and is, I am informed, named by the Singalese *Pangirimana*, or aromatic *mana*. It is cultivated near Galle and other parts of the Island, and also in Singapore, for its oil, known as *Citronelle* Oil.

Andropogon Khasianus, Munro, described by Hackel as a variety or another sub-species, grows in Sylhet. It closely approaches the last, differing from it by its branches being erect, not geniculate, and the hermaphrodite spikelet being aristate. A specimen of this is on the table.

Andropogon distans, described as a distinct species by Nees in Steudel's *Synop. Plant. Glum.*, Vol. I., p. 387, is considered to be a variety of *Nardus*, to which it is joined by numerous intermediate forms. Some specimens of these, found in this Presidency, and others in the N.-W. Provinces, and kindly lent by Mr. Duthie of Saharanpore, are laid on the table.

A. citratus, D.C. This grass, the leaves of which are sold in the bazaar, under the name of *Oli* and *Lili Cha* (green tea), yields lemon-grass oil, or the "oil of verbena" of commerce. In India it occurs in the cultivated state, being found only in gardens. In my paper above-mentioned, I have, following Munro and other authors, described this grass as growing wild in Ceylon, side by side with *A. Nardus*. I pointed out the close resemblance it (*A. citratus*) bears to the latter (*A. Nardus*), and that this would seem to suggest the idea that it is only a cultivated variety of *A. Nardus*. In the monograph on *Andropogone* recently published for DeCandolle's Prodromus, in April, 1888, Professor Hackel says: "*A. citratus*, mentioned by DeCandolle, in the catalogue of the Herbarium of Montpellier, without the description of flowers, belongs either to *A. Nardus* or *A. Schœnanthus*," thus confirming my surmise.

Please compare plate 280 given by Wallich in his *Plantæ Asiaticæ Rariores*, under the name of *Andropogon Schœnanthus*, with the plate of Trimen and Bentley above referred to, and the two dry specimens exhibited here, one collected in the garden of the Bishop of Damaun at Colaba, and the other sent by Mr. Duthie, and marked *A. Nardus*. These specimens closely resemble each other.*

A. Schœnanthus, Linn., known to Europeans as ginger-grass, and to the people of this country as *Rosha*, *Roosha*, &c., is, as I said in my former paper, the best known of all the scented *Andropogons*. It is found growing wild all over India, Ceylon, Macao, and Africa. In this Presidency it is common everywhere. Those who have been in Poona or Mahableshwar will have found its high culms hanging by the roadsides, specially as one approaches Panchgani. In Khandeish, an oil named *Rosha* oil, is distilled from it.

A. versicolor, Nees, *Steud. Synop. Plant. Glum.*, Vol. I., p. 388, is given by Hackel as a variety of *A. Schœnanthus*, Linn. It grows in Ceylon, the Nilghiris, Africa, and Mauritius; see a specimen on the table, which is not easily distinguishable from some belonging to *A. Schœnanthus*.

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* At the time I read my first paper, I had not seen Hackel's Monograph.

A. Laniger, Desf., *Fl. Atl.* Vol. II., 379.—This is a small, beautiful, slender grass, known as Woolly Andropogon, common in arid tracts of Africa and Asia. My specimens are from Sind and Baroda. Its roots are, as stated before, used in some places as *Kaskas* for making tatties, &c.

A. Iwarancusa, Roxb., *Fl. Ind.*, Vol. I., 275; Trin., *Sp. Gram. Tab.* 326. It is a tall grass with erect culms, 2 to 6 feet high, and a long linear intercepted panicle, consisting of numerous flowering branches, or spikes densely fasciculated. It grows in the plains, near the foot of the Himalayas, Hurdwar, Nepal, and Karachi; also in various parts of Africa. Dalzell and Gibson, the authors of the *Bombay Flora*, state:—"It is particularly mentioned by Arrian in his account of Alexander's journey through the Punjab and Sind, and was gathered by the Phœnician followers of the army in Lus, who called it Spikenard." It is common about Karachi, and is used as a scent by natives. It may be found in the Amdabhad Zilla, but we think that there must be some mistake as to its having been found in the moist Konkan, as stated in Graham's *Catalogue of the Bombay Plants*. Now, this plant, or some of its varieties, are not easily distinguishable from *A. Laniger*, Desf., as you may gather by comparing the specimens of the two plants laid before you. In fact, in my former paper, this difficulty in distinguishing one grass from the other was thus mentioned: "Roxburgh, in his *Flora Indica*, describes an aromatic species of *Andropogon* under the name of *A. Iwarancusa*. Some botanists, however, think that the description applies partly to *A. Laniger* and partly to *A. Schœnanthus*. Others believe that there is in Northern India a grass with white hairs which, though closely allied to *A. Schœnanthus*, is a distinct species."

The whole plant—roots, leaves, and inflorescence—is aromatic. It is however not known whether any oil is distilled from it. It is said that the aromatic roots are used by the people of Northern India in cases of intermittent fever. Plants belonging to this group of *Andropogons* or the following four species are described by Munro, Thwaites, Hamilton, &c.:—

1st—*A. commutatus*, Steud., *Synop. Plant. Glum.*, Vol. I., 387, growing in Sind and Abyssinia.

2nd—*A. Gidarba*, Hamil., Steud., *Syn. Pl. Glum.*, Vol. I., 387, found in Monghyr. Both these are noted for terebenthine acrid odour and taste.

A. Hookeri, Munro, M. S. Hack. *Andropogoneæ* 614, allied to *A. commutatus*, and supposed to grow in Bhutan.

A. lividus, Thur., *Enum. Pl. Zeylan.*, 367, found in Ootacamund and Ceylon. Both these grasses are sweet-scented, but the odour is slight and weak.

A. squarrosus, Linn. fil., Suppl. 433; *A. muricatus*, Rets, *Obs.*, Vol. III., 43. It grows all over India, especially in humid warm places. In this Presidency it is cultivated, and is also found wild in all provinces. The plant is called *bala* and *valem*, and its fragrant roots, named *Kaskas*, are well known throughout India, and used for making tatties, fans, &c., and formerly for thatching bungalows in the Deccan. The flowering branches of this as well as of other beautiful grasses are sold in the bazaar.

A. Pertusus, Willd., *Sp.*, Vol. IV., 922; Roxb., *Fl. Ind.*, Vol. I., 259. This grass has an extensive range, being found all over India, Afghanistan, Ceylon, Mauritius, Timor, Java, Africa, and even in some parts of Italy. It is very common in Poona, at the end of the rains, when it is very conspicuous by its beautiful purple panicle, consisting of 4 to 6, in some cases, even 10 spikes, congested at the top of the long peduncle. Its vernacular name is *Payen*, *Ganiamarvel*, *Palwan*, *Parwai*, *Palwa*. These names are also given to species of *A. annulatus*, Forstr., and *A. intermedius*, R. Br., the culms of which, like those of *pertusus*, are terminated by a crown of purple-coloured spikes. The spikelets of this species have, when crushed between the fingers, an agreeable aromatic odour, as may be ascertained by examining the specimens exhibited here. None of the agrostologists who have described this plant have, so far as I am aware. alluded to this property. Mr. Duthie, having had his attention drawn to it, says:—"The grass enclosed in yours of the 16th October, 1890, is certainly *Andropogon pertusus*. I was not aware of its being scented." The leaves are inodorous. The cattle do not seem to relish the plant.

A. odoratus. Under this name I have described in my last paper a tall grass with beautiful purple-coloured inflorescence, growing in various parts of this Presidency. It is very abundant in Lanowli in the fields beyond the woods, and all along the railway line, as far down as two or three stations on this side of Poona, where it is to be seen at the end of the rainy season, and it is called there *Gawat wedde.* As you must have noticed, it has a close affinity to *A. intermedius* of R. Br. I believe it is owing to this affinity, that in a letter dated September 2nd, 1890, written to Dr. Lisboa, Mr. Thiselton Dyer, Director of Kew Gardens, says:—"The claims to specific distinctness of *A. odoratus* are rather small." But Professor Hackel, who has, as stated before, written a monograph on *Andropogoneæ,* as late as 1889, by far the best work we have on the subject, in a letter written to Mr. Duthie, says:—"As to *Andropogon odoratus,* Lisb., of which you sent me a specimen, I believe that it can be maintained as a species, though the differences from *A. intermediatus* are slight ones, consisting chiefly in the amount of hairiness on the rachis and outer glumes. But the fact of the plant containing points of aromatic oil, which *A. intermediatus* is almost devoid of, indicates a true specific difference." The well-known botanist, Dr. Trimen, Superintendent of the Gardens in Peradenyia, Ceylon, in a letter written to Dr. Lisboa, says:—"I have to thank you for the specimens of your grass, *Andropogon odoratus,* which is a very interesting plant. So far as I can ascertain here, you are quite justified in describing it as new. It is possible, however, that it may prove to be the *A. Kuntzeanus,* recently described in Hackel's monograph of the *Andropoganeæ,* but his description does not quite fit it in all particulars, nor does he mention it as being scented. It came from Asirghar, Central India."

I am glad that Professor Hackel and Dr. Trimen support the view I had taken of the grass. The following characters led me to think that it is distinct from *A. intermedius.* The leaves are comparatively short and broad, cordate at the base, scabrous and scented, with long hairs, sparingly sprinkled here and there. Nodes, always covered with long white hairs, the rachis and the spikelets being also very hairy, and the whole plant, the leaves and inflorescence, especially the latter, highly scented.

In *A. intermedius* the nodes vary, with or without hairs; these when present being shorter and scanty; the leaves longer, narrower, and *inodorous, smooth* and *glabrous,* except at the base, which is fimbriated, the pedicle and glumes of the spikelets are sparingly pilose. If there is any scent in the spikelets, it must be a very faint one, or, as Hackel says, "*A. intermedius* is almost devoid of odour." R. Brown, who first described *A. intermedius*, G. Bentham, and other subsequent botanists, as far as I am aware, make no mention of the scent. Mr. Duthie, who has paid especial attention to Indian grasses, in his book, *The Fodder Grasses of N. India,* thus describes the grass: "A tall, rather coarse-looking grass with thick fibrous roots and long narrow leaves. It resembles *A. Ischæmum* and *A. pertusus* in general appearance. But the panicles are more elongated and much more loose." Here he makes no allusion to its odour. There are on the table side by side specimens of *A. odoratus* (dry and fresh), *A. intermedius*, and *A. Kuntzeanus.*

A. Ischæmum, Linn., Spa. It grows in Europe, Asia Minor, Africa, Afghanistan, China, Northern India, Rawal Pindi, the Punjab, Jeypur, Rajputana, Aligarh, and Allahabad, and is like *A. pertusus* and *A. annulatus*, named *Palwan*, &c.

A. micranthus, Kunth., *Enum. Pl.*, Vol. I., 504. It is found in various parts of India, and also grows in Australia, China, Japan, Philippine Islands, and Abyssinia. It is faintly odorous.

A. villosus, Steud., *Syn. Pl. Glum.*, I., 397. It is found in Nepal, the Khasia mountains up to 1,800 to 2,000 feet, Kumaon, Rajputana, and China.

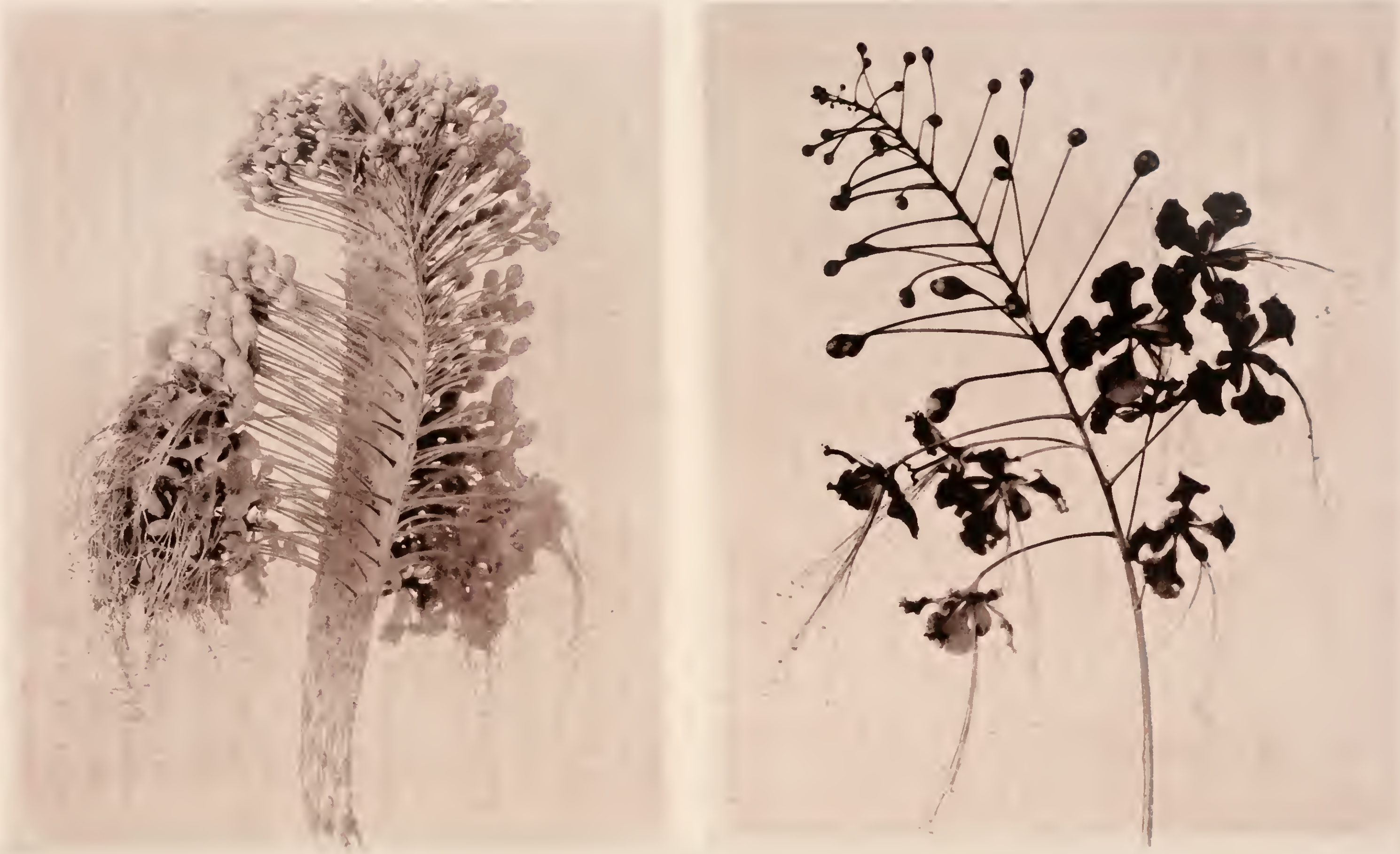
The specimen on the table is kindly lent by Mr. Duthie. It is to be noted that this *Andropogon* is described by Hackel under *A. micranthus*, as one of its varieties.

The following is a new *Andropogon*, hitherto undescribed :—

A. Hugelii, Hack., var. *A. fœtidus*, Hack. Vern.—*Podan, Padra, Kooli, Sipi, Kullus, Pâlan*, and *Patang*. Culm 2½—4 feet or more, slender, branching or decumbent, and sometimes rooting near the base, roundish, grooved on the side of branches and leaves, smooth, glabrous, of a pale purple colour. Sheaths smooth and polished, lower rather loose, upper appressed and somewhat carinate, glabrous, shorter than the nodes. Nodes bearded with soft white hair. Ligula

1 line long, truncate, ciliated. Leaves 5—8 in. long, 5 lin. broad; upper smaller, linear lanceolate, narrow rotundate at the base, terminated generally into an acute point, sparsely sprinkled with hairs on the lower surface, few or none on the upper, scabrous on both surfaces and margins, and distinctly divided into 2 unequal parts by a white rib, prominent on the lower surface. Panicle 5—7 inches; long, erect, much branched, supported on a long peduncle without a sheath. Rachis of faded purple colour, smooth or scabrous, from minute tubercles. Nodes 6—9 or more, lower internodes longer. Branches many at each node (6—12 at the lowest), alternate, capillary, smooth or scabrous, semi-verticelled, unequal in length, the longest often 5—6 nodes. Nodes of both the primary rachis and of the branches slightly swollen, bearded with soft white hairs. Primary branches give out at each node 2—3 secondary branches, and these, in their turn, yield smaller tertiary branches, the ultimate branches and the smaller primary ones bearing 3 terminal spikelets, one sessile, and two pedicellate, and generally three pairs below the triplet. Racemes very fragile, supported on peduncles free from hairs. The articulation of racemes and pedicels of the pedicellate spikelets short, hairy. Both sessile and pedicellate spikelets about 1½ lin., dull yellowish-white, or dingy-green, with a tuft of hairs at their base. Sessile spikelets linear, oblong. 1st glume 7—9 nerved, apex obtuse, margins slightly turned in, often ciliate, the dorsum scabrous; 2nd glume equal to the first, rather broader, obtuse at the apex, 5-nerved, glabrous; 4th a very slender awn, nearly 1 inch long, twisted to a little above the middle. The twisted part dark brown, the upper portion straight and light-coloured. An hermaphrodite flower in the axil. Pedicillate spikelets linear oblong; 1st glume obtuse at the apex, ciliolate at the margins towards the upper half, many-nerved; 2nd glume similar to the first, 3-nerved; 3rd glume hyaline, obtuse, nerveless, shorter but broader than the last two. 4th none. No awn; stamens 3; anthers one lin. long.

Common all over the Presidency, especially in Bassein, Thana, and over the Ghats. Specimens are received from Thana under the name of *Podan, Koolee, Sippee*; from Bassein with that of *Tam, Kullus*; and from Bhewndy, where it grows along the embankments and in Mahals, and is known as *Padra*. Used as fodder; no oil extracted. The



Mintern Bros. Photo. imp. London.

Abnormal Inflorescence Normal Inflorescence.

CURIOUS INSTANCE OF ABNORMAL INFLORESCENCE OF CÆSALPINIA (POINCIANA) PULCHERRIMA.

inflorescence is scented, the odour being soft and very pleasant, or in the language of Mr. Duthie, "deliciously scented." Hence the name, *A. fœtidus,* given to this plant, is, you will admit, inappropriate. But, perhaps, the sense of smell like that of taste may differ in different individuals. So far as I know, no agrostologist, not even Mr. Hackel, has as yet described it. When towards the end of 1889, we were informed that Hackel, considering the specimen sent to him by Mr. Duthie, belonged to a new *Andropogon,* had named it as above, it was suggested by me that *A. Hackelii* would be more appropriate. To this in a letter, dated 13th November, 1890, Mr. Duthie answered, "I think *A. Hackelii,* Lisb., would be a far more appropriate name. I should think he would have no objection to the alteration. I had better ask him." I would have still described it in honour of Professor. Hackel, but for the following letter of Mr. Duthie, dated 31st January last:—"Professor Hackel now reduces his *Andropogon fœtidus* to a variety of *Hügelii,* Hackel. He first gave the name *A. fœtidus* to specimens collected by me in the Nimar district two years ago. He did not reply to my question regarding the inappropriateness of the name *fœtidus.* He has probably written out a description which will shortly be published."

I am not aware that Professor Hackel has as yet published his. There is no doubt a close affinity exists between *A. Hügelii,* described by Hackel from the foot of the Himalayas, and *A. fœtidus,* found growing abundantly all over the Presidency, the North-Western Provinces and other parts of India, but the examination of the specimens of the two *Andropogons* exhibited here, show there are at least some apparent differences. The pedicillate spikelet is destitute of the fourth glume, whilst it is present in *A. Hügelii.*

CURIOUS INSTANCE OF ABNORMAL INFLORESCENCE OF *CÆSALPINIA* (*POINCIANA*) *PULCHERRIMA.*

THE accompanying plate contains an illustration of a curious instance of abnormal inflorescence of *Cæsalpinia* (*Poinciana*) *pulcherrima,* which was exhibited, some months ago, at a meeting of our Society, by Mr. E. S. Luard. In this case the peduncle and rachis were excessively developed and flattened, being about 1½ inches broad. On the two flattened surfaces the flowers were crowded together in great numbers, producing a very gorgeous effect.

Though the normal inflorescence is generally simple and unbranched, as shown in the figure, it very frequently happens, in the case of vigorous plants, that the inflorescence while continuing to grow towards its top also throws out several lateral branches. The abnormal inflorescence shown may be supposed to have been destined for a very large and branched inflorescence, which by some cause or other, the nature of which cannot be easily guessed, has been suddenly stopped in its axial growth, whereby the growth of the lateral branches has been so much accelerated, that they have not had time to assume their natural divergence, and originating in close proximity to each other, with their buds struggling to obtain the most favourable position for development, they have been so twisted and contorted, that they have all been united with the axis.

A photograph showing the normal inflorescence is also given for sake of comparison.

G. CARSTENSEN.

LANDSCAPE GARDENING IN NATIVE STATES.

By G. Carstensen, Superintendent, Victoria Gardens, Bombay.

Very little seems to be generally known of the present state of gardening in Native States, though there is no doubt that as rapid strides are being taken in this respect in those territories as in administration and education. I have, therefore, ventured in the following remarks to give a sketch of the more important gardens I lately have had the opportunity of visiting. Though the last place I visited, I shall first mention Baroda, because it undoubtedly occupies the first place from the point of view of the landscape gardener. The splendid new Luxmivilas Palace, now in the last stages of completion, can hardly be surpassed in architectural beauty or costiliness of interior decoration, and it is very rare in modern buildings to meet with so perfect and faultless a harmony of outlines. A building of this extent and beauty deserves to be surrounded by a garden which will not only rival it in beauty, but at the same time will assist in adding to the effect of its architectural features. H. H. the Gaekwar must, therefore, be congratulated on having perceived the necessity of allotting a large area to be laid out as garden and park, under the immediate supervision of an English specialist, Mr. Goldring, and of not saving any expense in endeavouring to obtain as successful results as possible. The work of laying out the grounds is still in its earlier stage, only the preliminary work of clearing away villages, outhouses, regulating nullahs, &c., having been completed. The works of road-making, terracing, rock-building, and planting are still in progress. From the various plans, models, &c., to which Mr. Goldring kindly gave me access, there appears, however, to be no doubt that the grounds, when completed, will represent features not found in other Indian gardens, and that the work will involve an expenditure quite unprecedented in India. It is impossible, at the present stage of the works, to form a correct judgment of the eventual results. It may, however, be hoped that they will be such as to justify the expenditure and labour bestowed upon the work. Among the principal features of the grounds there will be a sunk garden, ornamented with marble fountains, statues, and electric light; facing the palace will be another sunk garden, exclusively reserved for the Maharani and her lady-companions, and an architectural garden, all in the immediate vicinity of the palace. These are all features which, though more or less remnants of old styles of gardening, in which the art of design prevailed over the observance of natural beauty, still have their justification in the immediate vicinity of buildings, and other art objects. They prove most attractive when strictly in harmony with the adjacent buildings, so as to form a complement to them, and when the plants selected for decorating such gardens are of such a nature as to complete the harmony. In this last respect some difficulty will be found, both in the original planting and the maintenance of the gardens, and Mr. Goldring will deserve very great credit indeed if he succeeds, in such a climate as that of Baroda, in obtaining the effects so essential to a successful result in this branch of gardening. Another prominent feature is the embellishment of a nullah with artificial rocks, built in masonry and coated with a composition that gives them a natural colour. This kind of work is obviously of the very greatest difficulty unless carried out on a very large scale, so as to assume the proportions of natural rocks; where this is not feasible the result too often is that even the strictest attempts at a successful imitation of nature lead to the directly opposite result, and the artificial structure becomes prominently apparent. In this case the features are too small to assume any likeness to natural rocks, and even without considering the common occurrence of imposing rock-scenery in India, it is very doubtful whether its imitation is advisable in this climate, as the vegetation which is necessary to give relief to the artificial rocks, will probably in the course of time entirely hide the original outlines, unless it is permanently and severely restricted. The gardens in the interior courts of the palace, which are laid out in strict harmony with the building and in accordance with the style, are ornamented with basins and fountains, and are very attractive, and as it is possible here to maintain an artificial damp atmosphere, palms and ornamental foliage plants, such as crotons, alocasias, ferns, &c., which are such essential accessories to decorative gardening in India, are likely to flourish. The grounds surrounding the palace are richly studded with fine specimens of old and well-grown trees, among which chiefly some splendid tamarind trees are worthy of notice. They lend themselves excellently to the formation of a handsome park, though not possessing great variety of surface, nor offering specially attractive surroundings. The beauty of the future park will therefore almost solely depend on the effective distribution of plantations and open spaces, and much regret will be felt at the necessity of felling a considerable number of fine trees, without which, however, it will not be found possible to obtain the desired effects. The supervision of this work by such a specialist as Mr. Goldring ought, however, to be a sufficient guarantee for the due consideration of all pros and cons. Intimate as he is with English park scenery, no one knows better how to deal in the most judicious way with difficulties arising out of this or similar causes. Of planting so very little has been undertaken thus far, that a judgment cannot yet be pronounced. It may, however, be mentioned that large trees have been successfully transplanted by the aid of a transplanting machine (Barron's). This is, I believe, the first experience of this kind in

India, and may be found occasionally useful, though obviously not possessing the same advantages as in English gardens, as most trees in India do not require a very long period to attain a considerable size. Several temples, wells, and buildings are found scattered in the grounds, and will undoubtedly add to the variety, and become more or less attractive features.

The gardens at the Makurpuri Palace, the present residence of H. H. the Gaekwar, are in a more advanced state. They are, like the palace, which has no great claim to architectural beauty, planned partly in the Italian style. This style of gardening is better suited for the peculiar vegetation of Southern Europe, with its evergreen trees and shrubs, all of a more or less compact and stiff appearance, than for the drier parts of India. To obtain a harmony between this and the picturesque style of gardening to which the remainder of the grounds are being devoted is a task of no mean difficulty, and its success must principally depend upon the choice and distribution of plants. This part of the work has, however, not as yet been completed, so it would be unfair to base a judgment of the final appearance of the gardens on the present few attractive features which it possesses. The first attempts at embellishing the Italian gardens, undertaken during Mr. Goldring's absence in Europe, has proved an utter failure, and it appears to me very doubtful if complete success can ever be obtained in the dry climate of Baroda. I shall not tire the reader with a description of the band-stand, fountains, and other accessories of the gardens, but restrict my remarks to the principal feature of the gardens, the rock-garden. This includes water-courses of pleasing appearance, a large grotto, a water-fall, &c., and is no doubt a remarkable work, on which large sums and great labour have been expended, and with which no similar work in India can be compared. But to everybody acquainted with Indian rock scenery, or any of the numerous Buddhist caves, it cannot fail to seem more like a beautiful toy, than a work of art, which is the more regrettable as Mr. Goldring has taken infinite pains in obtaining an effective result.

The gardens surrounding the Nussarbagh Palace, the former residence of the Court, have undoubtedly been neglected for some years past, but bear evident traces of having been laid out with great taste, and in strict harmony with the palace. If properly kept up, and retained in their original style, the artificiality of which is so prominent in the white marble-paved walks, fountains, and covered walks, and by the predominance of lime-trees in the plantations, they would remain one of the finest specimens of architectural gardening in India.

The Public Park in Baroda, situated between the native town and the camp, is very extensive (about a hundred acres, I believe) and attractive. The river Vishwamitri winds its course through the park, and is crossed by several more or less ornamental bridges. The steep river-banks are here and there varied by the presence of an ancient picturesque temple, or by solemn thick groves of shady old tamarind-trees, by clusters of graceful bamboos, or bits of babul-jungle, and are almost everywhere thickly studded with clumps of arundo and munj-grass—(*Saccharum sara*)—which latter by its graceful feathery silver-like flower-spikes, comes near to rivalling the well-known pampas-grass in beauty. Following the course of the river, many bits of beautiful scenery and objects pleasing to the eye are met with, but at the same time the intelligent observer cannot fail to see what excellent conditions for scenery of far greater beauty and of imposing grandeur present themselves, but at present are not made the most of. Another special feature of the park are the numerous clumps of bamboos, of which several kinds are met with. The park is just old enough to have acquired the peculiar attractiveness which old and well-grown shady trees always lend to garden scenery, and contains several fine specimens of trees, many of which are but rarely met with in Indian gardens. I could obtain no information, as to who originally designed the plan of the park, and should the name be known, it had better remain unpronounced, as the designer has evidently been totally ignorant of the art and requirements of landscape gardening, and even perfectly destitute of taste, the principal qualification for landscape gardening. The most prominent fault, a fault that too often betrays the hand of amateurs in landscape gardening, is the far too great number of roads and footpaths, the majority of which are perfectly aimless, and too often do not serve any other purpose than to destroy effects which in their absence might be pleasing and attractive. The original plan is defective also with regard to the distribution of plantations, and from the beginning the uneffective treatment of light and shade has been further sinned against by subsequent planting, without any noticeable thinning of the original plantations. The consequence is that the park is at present not much more than a wilderness without character, instead of the beautiful park which the local conditions and the unusual advantage of charming river-scenery are so eminently favourable for creating, and almost seem to claim as a necessity. Great improvements could, however, easily be obtained, and a very few weeks' work with the felling axe, under able supervision, would entirely alter the character of the park and vastly add to its attractiveness and beauty. I understand it is H. H. the Gaekwar's intention to have the park entirely remodelled, as soon as the new gardens, now being laid out, have been completed. The Park contains a rather large plant house, of which the chief attractions are a few large palms, among which is an unusually fine and large clump of the cane-palm (*Calamus rotang*); but the almost entire absence of ferns, to which plant-houses in Bombay owe their principal charm and beauty, is strikingly felt. The zoological collection, which contains the common kinds of wild animals, as tigers, panthers, lions, bears, besides a few deer, is greatly in need of better accommodation, as will be easily perceived from the fact of the deer being tied up to trees by ropes, but also in this respect improvements are under contemplation. As the able Superintendent of the Park, Mr. T. M. Henry, was absent on leave during my visit, it would be unfair, from the present state of the Park, to form any opinion as to its general maintenance.

Though not a garden, the Camp must be mentioned as a feature of unusual grandeur and beauty. The "maidan," one of the largest and finest in India, surrounded by beautiful groves of old trees, bears ample evidence of the presence of a masterhand in creating a most perfect picture. The broad avenues, the thick clusters of trees, and the few but wonderfully fine trees scattered over the large open space, present a scenery, the beauty of which could not be obtained except by judicious co-operation with nature, and may, as far as my information goes, be credited to the hand of the late Sir James Outram.

There can be no doubt that Baroda, as regards the extent of its gardens, and the annual expenditure incurred in their maintenance, far surpasses any other town in this Presidency. Though the climate is of such a nature as never to allow of that luxuriance in vegetation, which forms the principal attractiveness of Bombay gardens, the gardens in Baroda will, owing to the almost unlimited expenditure on their laying out and maintenance, eventually possess features which never can be dreamt of in Bombay. It is, however, a consolation to know that the specially favourable climatic conditions of Bombay make it possible here to obtain far greater and more impressive effects at a comparatively low expenditure.

Another flourishing Native State, Bhownugger, which presents in all respects most interesting features, and which, when the works now under construction are completed, will possess some of the finest modern buildings in India, has also with regard to gardening kept pace with the times, and it is well worthy of notice that what in this respect has been successfully accomplished has been done without the assistance of a European gardener. The public gardens, called the Peile Gardens, are a proof of what successful results may be arrived at by energy and skill, aided by practical judgment and a liberal expenditure. The site now occupied by the gardens was but six years ago a piece of waste ground. The area of the garden is limited, and its shape anything but a desirable one for a garden. Though the gardens do not pretend to closely follow the principles of landscape-gardening, no serious or apparent sins against these principles, which are but too often overlooked in gardens of this kind, are met with, and the talented State-Engineer, Mr. Proctor Sims, to whose genial taste and skill this, as almost all of the many remarkable public works in the State are due, deserves very great credit for the results obtained. If any objection can be taken to the design of the gardens, it is a perhaps a little too close adherence to straight lines; but the destribution of trees and shrubs has been so successfully planned and carried out, as to perfectly counteract any undue uniformity and stiffness that is generally likely to result from this cause. Whether it be accidentally or intentionally, the general effect is to make the gardens appear considerably larger than they actually are. The excellency of the turf in the well-kept lawns is a feature which is rarely met with up-country, and which is not surpassed even in Bombay. This fact proves that the maintenance of lawns, one of the most useful ornaments of gardens, is possible in even a comparatively dry climate, when sufficiently supplied with water. The size, shape, and choice of trees show how rapidly and successfully the growth is fostered under climatic conditions that are generally considered less favourable than those prevailing in Bombay, while it is quite out of the question to expect certain trees, as the nim, the tamarind, the millingtonia, the horse-radish tree, to grow to such perfection, and to assume such well-regulated shapes in Bombay as the case is here. The almost entire absence of crotons and other brightly-coloured shrubs in the gardens is a striking contrast to the ordinary features of Bombay gardens. But several fine specimens of palms, and not least, the very effective and ornamental manner in which an approach to an old well is decorated, amply prove that a luxuriant tropical vegetation is possible, even where the choice of plants is so severely restricted by the climate as here. The more or less accessory ornaments in the gardens are all in excellent taste. The band-stand, at which H. H. the Thakore Saheb's band performs twice a week, is a very attractive feature. It is an octagonal rustic pavilion, covered with creepers, at the summit of the roof is a carved figure apparently of Orpheus, while the rafters which carry the roof are most skilfully terminated in various animals' heads, and show signs of no mean skill in wood carving, an art for which Bhownugger is justly celebrated. The plant-house is a handsome structure, in the centre of which is a large oblong ornamental tank, and is tastefully studded with groups of palms, crotons and other foliage plants, but here, as in Baroda, owing to the dryness of the climate, ferns are almost entirely missing. It is occasionally used for festive banquets, and must when lighted up present a very attractive appearance. A spiral staircase leads to a kind of gallery from which a bird's-eye view may be obtained not only of the interior of the plant-house, but also of the whole of the gardens. The cages in which the small collection of wild animals is housed, deserve to be mentioned as appearing to be comparatively inexpensive, very simple and admirably adapted to resist the heat of the Indian sun, while they are at the same time well ventilated and are not wanting in ornamental appearance. According to modern ideas they have the fault, however, of not being isolated, and of not being sufficiently raised above the ground. Each cage consists of a spacious cell, enclosed by thick walls on the western and eastern side, while the south side is furnished with bars. As the sun is never low enough to enter the cage from this direction, the inside is as cool as possible, and coolness is further guaranteed by a roof of corrugated iron-plates, supporting a moderately thick layer of soil, which is turfed and constantly kept cool by watering. This cell, which seems to be the favourite resort for the animals at all times of the day, is on the northern side separated from an outer open-air cage of similar size by gratings with doors. The collection contains among other animals, a remarkably fine pair of Kathiawar lions, which like the other animals seem to be in a very flourishing and healthy condition. The deer-park, which is simply fenced with barbed wire, is fairly large, but contains only a few kinds of deer. A white peacock, some very fine cockatoos, and a good specimen of a sea eagle, may be noticed in the collection of birds. The garden at Moti Bagh is, like the palace, without pretensions to beauty, but is now being remodelled. The nurseries of plants are well kept, and contain a good stock of healthy young plants. The cultivation of fruit trees is rather an important feature of the Bhownugger gardens, and a visit to the Dewan's summer-house, which is surrounded by probably the best orchard in India, well repays the short drive from the town.

The admirably systematic arrangement, the flourishing and well-regulated growth of the trees, as also the unusually neat appearance of the whole orchard, forcibly reminded me of well-kept market gardens at home, naturally allowing for the difference of trees and the entirely Indian system of irrigation. The principal fruit-trees found here are pomegranates, limes, figs, oranges, plantains, and papayas, of which each occupy a separate quarter. I do not quite recollect if custard-apples, mangoes, and cocoanuts are cultivated here, but the first of these are successfully grown in other gardens, while the cultivation of the two latter kinds is rarely attended with success. Pomegranates, limes, and figs are extensively cultivated in the neighbourhood of Bhownugger, and are, I was told, principally exported to Bombay. About two miles from the town the site reserved for the Victoria Park is reached. It forms part of the Bhir, an extensive stretch of uncultivated land, principally covered with babool jungle, of which an area of 450 acres was fenced in by an earthen embankment during the last famine a few years ago, and, by the well-known liberality of H. H. the Thakore Saheb, reserved for the formation of a park, which His Highness is anxious should in every way be worthy of the high and distinguished name it bears. The natural conditions are almost without exception in the highest degree favourable for the formation of a park of unusual beauty. The great variety in the surface, in a few places rising to hills of not inconsiderable elevations, the beautiful natural lake surrounded by babool forest, the numerous exceptionally fine trees, and not least the varied objects of interest or picturesque effects in the surroundings, are all features that by a considerate assistance of nature, a suitable selection of trees, and the effective grouping and distribution of plantations, will make it possible to create a scenery of great æsthetic effect and of rare beauty, without having recourse to any artificial means, which, unless employed with the very greatest skill, and executed on such a scale as to compare favourably with the natural objects they are supposed to represent, are generally in bad taste, and calculated to mar the effect of natural park scenery. Several gardens, the European cemetery, and a large plantation, chiefly consisting of casuarinas, also deserve to be mentioned as bearing evidence of the great interest taken in tree-planting, a feature which is also prominently noticed at Ghadechi, the not very distant Railway depôt, which can even boast of having a public garden of its own, though this is very small and unpretentious. No visitor to the neighbourhood of Bhownugger can fail to observe the splendid condition of the crops, principally cotton, and the exceptionally high state of agriculture, a not very common feature in India. It may perhaps interest the reader to learn that Bhownugger possesses an incinerator, in which the town sweepings and night-soil are by combustion rendered fit for supplying a most valuable and largely-used manure. About ten miles distant from Bhownugger, at Mohwar, the State possesses a very extensive plantation of cocoanut-palms, date-palms, and bamboos, which I however regret not to be able to describe, as I had no opportunity of visiting it. In reviewing my general impressions of gardening in Bhownugger, I cannot but arrive at the conclusion that though Baroda has been mentioned in the first place, as regards the extent and number of its gardens, it is especially when the disadvantages of the climate in Bhownugger are considered, excelled by the latter State in respects to practical results. Gardens and plantations of some importance are, I believe, found here and there in Kathiawar, but as Rajkot was the only place I had the opportunity of visiting, I must confine my remarks to this place.

Rajkot is, as is well-known, situated in the centre of Kathiawar, and might be supposed to me most unsuitable for gardening, when the scantiness of the annual rainfall (averaging 18 inches) and the dryness of the atmosphere are considered. It is therefore as welcome as unexpected a surprise to enter, what may be almost called an oasis in the desert, after having traversed the barren and scantily cultivated districts through which the Morvi Railway passes. The principal object of interest is the Rajkumar College, a handsome building in pure Gothic style, to which an extensive garden is attached. The garden, though laid out without pretensions to æsthetic effects, leaves a pleasing impression, the trees and plants being in a flourishing condition and the gardens well kept. An avenue of the Sumatran Cassia (*Vilaite Arul*), which here forms a very handsome and shady tree, is very effective. Though the choice of kinds is necessarily limited, I was very much impressed by the successful results of planting. It may be hoped that the daily contemplation of such pleasing surroundings may strike root and awake an interest in planting among the native princes who here receive their education. The success may, I believe, be solely attributed to the talented Principal of the College, Mr. MacNaughten, who is, I was told, himself considerably interested in botany and gardening—a fact which is a promising guarantee for the wider effects of the successful results. The so-called Public Park is located near the College, but has no pretensions whatever to its high-sounding name, being only a very narrow strip of garden, of which the less said the better. The garden surrounding the Residency is rather extensive and contains several objects of interest. The present Political Agent, Mr.

E. C. K. Ollivant, whose warm interest in gardening has accomplished such excellent results in Bombay, is rapidly improving the garden, and has already introduced several plants, hitherto unknown in Rajkot, and will no doubt materially encourage gardening there and assist in bringing it to a high degree of perfection. The fernery, lately erected near the Residency, and which is approached by a most ingeniously laid-out garden, gay with coloured shrubs and annuals in flourishing condition, bears witness to Mr. Ollivant's great taste and skill. It would lead too far here to enter into a detailed enumeration of the plants which succeed in Rajkot. Suffice it to mention that roses, geraniums, stephanotis, and many other choice plants here grow to great perfection. It is, however, found necessary to grow most plants in hollowed beds, with the object of retaining the water, or on banks enclosed by stones which tend to retain the moisture. Lawns are a hitherto unknown feature in Rajkot, but I have no doubt that repeated attempts will eventually prove successful, if the water-supply will suffice for their maintenance.

Having observed the successful results of tree-planting in Rajkot on the road-sides and near all stations of importance—such as Wadhwan, which is notoriously dry, and where tree-planting was originally initiated by the Hon. Mr. Justice Birdwood, when residing there several years ago—I have no hesitation in expressing my belief, that a great deal might be effected by judicious tree-planting in Kathiawar. It might even be probable by this means, eventually, to counteract some of the most important defects of the climate, and at the same time to add variety and picturesque beauty to the present desolate and uninteresting features of the greater part of the country.

(The above appeared in the *Bombay Gazette* on the 22nd and 29th November, 1890.)

LIST OF BIRDS' EGGS IN THE SOCIETY'S COLLECTION

On 1st January, 1891.

Jerdon's No.	Scientific Name.	Popular Name.	No. of Eggs.
2	Otogyps calvus, *Scop*................	The King Vulture	1
4*bis.*	Gyps pallescens, *Hume*............	The Long-billed Pale Brown Vulture.	1

Jerdon's No.	Scientific Name.	Popular Name.	No. of Eggs.
5	Pseudogyps bengalensis, *Gm.*	The White-backed Vulture	1
6	Neophron ginginianus, *Lath*	The Scavenger Vulture	1
11	Falco juggur, *J. E. Gr.*	The Juggur Falcon	1
23	Astur badius, *Gm.*	The Shikra	2
29	Aquila vindhiana, *Frankl.*	The Tawny Eagle	10
33	Nisaetus fasciatus, *Veille.*	The Crestless Hawk Eagle	1
42	Haliaëtus leucoryphus, *Pall.*	The Ring-tailed Fishing Eagle	2
48	Butastur teesa, *Frankl.*	The White-eyed Buzzard	2
56	Milvus govinda, *Sykes.*	The Pariah Kite	8
69	Bubo bengalensis, *Frankl.*	The Rock Horned Owl	6
70	Bubo coromandus, *Lath.*	The Dusky Horned Owl	1
76	Carine brama, *Tem.*	The Spotted Owlet	10
84	Hirundo filifera, *Steph.*	The Wire-tailed Swallow	8
85	Hirundo erythropygia, *Sykes.*	The Red-rumped Swallow	4
86	Hirundo fluvicola, *Jerd.*	The Indian Cliff Swallow	1
90	Ptyonoprogne concolor, *Sykes.*	The Dusky Crag Martin	4
100	Cypsellus affinis, *J. E. Gr.*	The Common Indian Swift	6
103	Collocalia unicolor, *Jerd.*	The Edible Nest Swiftlet	2
112	Caprimulgus asiatica, *Lath.*	The Common Indian Nightjar.	4
114	Caprimulgus monticulus, *Frankl.*	Franklin's Nightjar	2
117	Merops viridis, *Lin.*	The Common Indian Bee-eater	1
118	Merops philippinus, *Lin.*	The Blue-tailed Bee-eater	1
121	Merops apiaster, *Lin.*	The European Bee-eater	1
123	Coracias indica, *Lin.*	The Indian Roller	8
125	Coracias garrula, *Lin.*	The European Roller	1
129	Halcyon smyrnensis, *Lin.*	The White-breasted Kingfisher	8
134	Alcedo bengalensis, *Gm.*	The Indian Kingfisher	3
144	Ocyceros birostris, *Scop.*	The Common Grey Hornbill	3
148	Palæornis torquatus, *Bodd.*	The Rose-ringed Paroquet	3
149	Palæornis purpureus, *P.L.S.Mull.*	The Rose-headed Paroquet	3
160	Picus mahrattensis, *Lath.*	The Yellow-fronted Woodpecker.	2
193 *bis.*	Megalæma inornata, *Wald.*		
197	Xantholœma hæmacephala (*P.L. S. Mull*)	The Western Green Barbet	1
		The Crimson-breasted Barbet	6
212	Coccystes jacobinus, *Bodd*	The Pied Crested Cuckoo	2
214	Eudynamis honorata, *Lin.*	The Indian Koel	4
217	Centrococcyx rufipennis, *Ill.*	The Indian Coucal	6
234	Cynnyris asiatica, *Lata.*	The Purple Honey-sucker	3
240	Piprimosa agile, *Tick.*	The Thick-billed Flower-pecker	7
256	Lanius lahtora, *Sykes.*	The Indian Grey Shrike	2
257	Lanius erythronotus, *Vig.*	The Rufous-backed Shrike	3
260	Lanius vittatus, *Valenco.*	The Bay-backed Shrike	5
265	Tephrodornis pondiceriana, *Gm.*	The Common Wood Shrike	2
268	Volvocivora sykesi, *Strickl.*	The Black-headed Cuckoo Shrike.	1
276	Pericrocotus peregrinus, *Lin.*	The Small Minivet	2
277	Pericrocotus erythropygius, *Jerd.*	The White-bellied Minivet	2
278	Buchanga atra, *Herm.*	The King-Crow	10
288	Muscipeta paradisi, *Lin.*	The Paradise Fly-Catcher	2
292	Leucocerca aureola, *Veill.*	The White-browed Fantail	4
342	Myiophoneus horsfieldi, *Vig.*	The Idle Schoolboy	2
354	Geocichla cyanotis, *Jerd.*	The White-winged Ground Thrush.	2
359	Merula nigropilea, *Lafor.*	The Black-capped Black-bird	6
385	Pyctoris sinensis, *Gm.*	The Yellow-eyed Babbler	4
389	Alcippe poiocephala, *Jerd.*	The Quaker Thrush	2
391	Stachyris nigriceps, *Hodg.*	The Black-headed Wren Warbler	2

Jerdon's No.	Scientific Name.	Popular Name.	No. of Eggs.
397	Dumetia hyperythra, *Frankl.*	The Rufous-bellied Babbler	2
407	Garrulax leucolophus, *Haraw.*	The White-crested Laughing Thrush.	2
410	Garrulax ruficollis *J. Lard & Sclb*	The Rufous-necked Laughing Thrush.	4
412	Garrula pectoralis, *Gould*	The Black-gorgetted Laughing Thrush.	3
422	Trochalopterum phœniceum, *Gould.*	The Crimson-winged Laughing Thrush.	2
432	Malacocercus terricolor, *Hodgs.*	The Bengal Babbler	1
435	Malacocercus somervillei, *Sykes.*	The Rufous-tailed Babbler	2
436	Argya malcolmi, *Sykes.*	The Large Grey Babbler	4
438	Chatarrhœa caudata, *Dum.*	The Striated Bush Babbler	9
452	Ixus luteola, *Less.*	The White-browed Bush Bulbul.	1
458	Otocompsa leucogenys, *J.E. Gr.*	The White-cheeked Crested Bulbul.	5
460 *bis.*	Otocompsa fuscicaudata, *Gould.*	The Southern Red-whiskered Bulbul.	2
461	Molpastes pygæus, *Hodgs.*	The Common Bengal Bulbul	3
462	Molpastes hœmorrhous, *Gm.*	The Common Madras Bulbul	4
468	Iora tiphia, *Lin.*	The White-winged Iora	2
470	Oriolus kundoo, *Sykes.*	The Indian Oriole	2
475	Copsychus saularis, *Lin.*	The Magpie Robin	2
479	Thamnobia fulicata, *Lin.*	The Indian Black Robin	3
480	Thamnobia cambaiensis, *Lath.*	The Brown-backed Indian Robin.	7
494	Cercomela fusca, *Bly.*	The Brown Rock-Chat	6
505	Rhyacornis fuliginosa, *Vig.*	The Plumbeous Water Robin	1
530	Orthotomus sutorius, *Forst.*	The Indian Tailor Bird	5
535	Prinia stewarti, *Bly.*	Stewart's Wren Warbler	3
538	Prinia gracilis, *Frankl.*	The Malabar Wren Warbler	7
539	Cisticola cursitans, *Frankl.*	The Rufous Grass Warbler	2
543	Drymœca inornata, *Sykes*	The Common Wren Warbler	15
545	Drymœca sylvatica, *Jerd.*	The Jungle Wren Warbler	4
547	Suya crinigera, *Hodgs*	The Brown Mountain Wren Warbler.	2
549	Suya atrigularis, *Moore*	The Black-breasted Wren Warbler.	1
551	Franklinia buchanani, *Bly.*	The Rufous-fronted Wren Warbler.	2
582	Sylvia affinis, *Bly.*	The Lesser White Throat	1
589	Motacilla maderaspatensis, *Gm.*	The Pied Wagtail	3
600	Corydalla rufula, *Vieill.*	The Indian Titlark	2
631	Zosterops palpebrosa, *Tem.*	The White-eyed Tit	8
660	Corvus macrorhynchus, *Wagl.*	The Bow-billed Corby	4
663	Corvus splendens, *Veille*	The Common Indian Crow	2
674	Dendrocitta rufa, *Scop.*	The Common Indian Magpie	2
677	Dendrocitta frontalis, *Mc. Clell.*	The Black-browed Magpie	3
682	Sturnus nitens, *Hume*	Hume's Starling	1
683	Sturnopastor contra, *Lin.*	The Pied Starling	3
684	Acridotheres tristis, *Lin.*	The Common Myna	3
685	Acridotheres ginginianus, Lath.	The Bank Myna	4
687	Sturnia pagodarum, *Gm.*	The Black-headed Myna	4
694	Ploceus philippinus, *Lin.*	The Common Weaver Bird	4
695	Ploceus manyar, *Horsf.*	The Striated Weaver Bird	5

Jerdon's No.	Scientific Name.	Popular Name.	No. of Eggs.
695	Ploceus bengalensis, *Lin.*	The Black-throated Weaver Bird.	2
698	Amadina rubronigra, *Hodgs.*	The Chestnut-bellied Munia	2
699	Amadina punctulata, *Lin.*	The Spotted Munia	1
703	Amadina malabarica, *Lin.*	The Plain Brown Munia	5
706	Passer domesticus, *Lin.*	The House Sparrow	2
724	Melophus melanicterus, *Gm.*	The Crested Black Bunting	2
756	Mirafra erythroptera, *Jerd.*	The Red-winged Bush Lark	2
760	Pyrrhulauda grisea, *Scon.*	The Black-bellied Finch Lark.	5
765	Spizalauda deva, *Sykes.*	The Small Crown Crest Lark	1
788	Columba intermedia, *Strickl.*	The Blue Rock Pigeon	2
794	Turtur senegalensis, *Lin.*	The Little Brown Dove	1
795	Turtur suratensis, *Gm.*	The Spotted Dove	2
796	Turtur risorius, *Lin.*	The Common Ring Dove	4
802	Pterocles exustus, *Tem.*	The Common Sand Grouse	3
803	Pavo cristatus, *Lin.*	The Pea-Fowl	4
803 *oct.*	Megapodius nicobaricus, *Bly.*	The Nicobar Mound Bird	1
814	Galloperdix spadiceus, *Gm.*	The Red Spur-Fowl	4
816	Tetraogallus himalayensis *G.R.Gr.*	The Himalayan Snow-Cock	1
819	Francolinus pictus, *Jerd.*	The Painted Partridge	1
820	Caccabis chukor, *J. E. Gr.*	The Chukor Partridge	2
822	Ortygornis pondicerianus, *Gm.*	The Grey Partridge	2
823 *bis.*	Perdix hodgsoniæ, *Hodgs.*	The Tibetan Partridge	9
826	Perdicula asiatica, *Lath.*	The Rock Bush Quail	2
830	Coturnix coromandelica, *Gm.*	The Black-breasted Rain Quail	5
832	Turnix taigoor, *Sykes.*	The Black-breasted Bustard Quail.	6
836	Eupodotus edwardsi, *J. E. Gr.*	The Indian Bustard	1
839	Sypheotides aurita, *Lath.*	The Likh	5
843	Glareola lactea, *Tem.*	The Small Swallow Plover	2
847	Ægialitis mongola, *Pall.*	The Lesser Sand Plover	5
855	Lobivanellus indicus, *Bodd.*	The Red-wattled Lapwing	6
856	Lobipluvia malabarica, *Bodd.*	The Yellow-wattled Lapwing	3
858	Æsacus recurvirostris, *Cuv.*	The Large Stone Plover	1
859	Œdicnemus scolopax, *S.G. Gm.*	The Stone Plover	2
863	Grus antigone, *Lin.*	The Sarus	3
873	Rhynchæa bengalensis, *Lin.*	The Painted Snipe	4
900	Parra indica, *Lath.*	The Bronze-winged Jacana	4
901	Hydrophasianus chirurgus, *Scob.*	The Pheasant-tailed Jacana	6
902	Porphyrio poliocephalus, *Lath.*	The Purple Coot	1
903	Fulica atra, *Lin.*	The Coot	3
905	Gallinula chloropus, *Lin.*	The Moor-Hen	3
907	Erythra phœnicura, *Penn.*	The White bellied Water Hen.	4
909	Porzana maruetta, *Leach*	The Spotted Crake	1
913	Hypotænidia striata, *Lin.*	The Blue-breasted Rail	2
920	Dissura episcopa, *Bodd.*	The White-necked Stork	1
923	Ardea cinerea, *Lin*	The Blue Heron	1
925	Herodias torra, *B. Ham.*	The Large Egret	3
926	Herodias intermedia, *Hass.*	The Smaller Egret	3
927	Herodias garzetta, *Lin.*	The Little Egret	1
929	Bubulcus coromandus, *Bodd.*	The Cattle Egret	5
930	Ardeola grayi, *Sykes.*	The Pond Heron	4
933	Ardetta cinnamomea, *Gm.*	The Chesnut Bittern	4
937	Nycticorax grisea, *Lin.*	The Night Heron	3
938	Tantalus leucocephalus, *Forst.*	The Pelican Ibis	5
939	Platalea leucorodea, *Lin.*	The Spoonbill Heron	4
940	Anastomus oscitans, *Bodd.*	The Shell Ibis	6
941	Ibis melanocephala, *Lath.*	The White Ibis	6

Jerdon's No.	Scientific Names.	Popular Names.	No. of Eggs.
944	Phœnicopterus antiquorum, *Tem*	The Flamingo	1
950	Sarcidiornis melanonotus, *Penn.*	The Comb Duck	4
969	Fuligula nyroca, *Guld.*	The White-eyed Pochard	2
970	Fuligula marila, *Lin*	The Scaup	1
972 *bis.*	Mergus serrator, *Lin*	The Red-breasted Merganser	4
975	Podiceps minor, *Gm*	The Dabchick	7
984	Hydrochelidon hybrida, *Pall*	The Marsh Tern	4
985	Sterna seena, *Sykes.*	The Large River Tern	5
988 *ter.*	Sterna saundersi, *Hume.*	Saunder's Little Tern	2
989	Sterna bergii, *Licht*	The Large Sea Tern	3
990	Sterna media, *Horsf*	The Smaller Sea Tern	3
1004	Pelecanus Philippensis, *Gm.*	The Grey Pelican	3
1006	Phalacrocorax fuscicollis, *Step*	The Lesser Cormorant	2
1007	Phalacrocorax Pygmæus	The Little Coromorant	5
1008	Plotus melanogaster, *Penn.*	The Snake Bird	6
	Tetra tetrix	The Black Grouse	1
	Struthio camelus	The Ostrich (laid in Bombay)	2
	Dromaius novæ-hollandiæ	The Emu (laid in Bombay)	1

THE PRESERVATION OF INSECTIVOROUS BIRDS, BIRDS OF PLUMAGE, AND GAME IN THE CENTRAL PROVINCES.

Extract from the Proceedings of the Chief Commissioner, Central Provinces, in the General Department. Dated Nagpur, the 3rd January, 1890.

RESOLUTION.

The question of doing something to protect the insectivorous birds and birds of plumage, and to stop the indiscriminate slaughter of game at all seasons of the year, has been for some time past under the consideration of the Chief Commissioner. After consulting Colonel Doveton, the Conservator of Forests, and Mr. R. Thompson, late Deputy Conservator of Raipur (now Officiating as Conservator of the Southern Circle), Mr. Mackenzie has come to the conclusion that, although the subject can perhaps only be effectually dealt with by legislation, it is possible to take some tentative steps in this direction under the provisions of the Forest Act and the Rules regulating the grant of licenses to use fire-arms. The necessity of early action in the matter has been pressed upon the Chief Commissioner from various quarters. The destruction of birds, for the sake of their feathers, has in some districts been carried to such lengths as to threaten the extermination of several interesting species, and the operations of Native Shikaris are similarly bringing about the extinction of various kinds of deer and antelope.

2. In October, 1888, Mr. Thompson, whose authority as a naturalist and sportsman is beyond dispute, submitted to the Chief Commissioner a rough draft of a

list of those birds which in his opinion ought to be protected. He divided his list into two classes, thus :—

CLASS A.—Birds which destroy insects and other pests injurious to vegetation.

CLASS B.—Birds the flesh of which is used for human food.

CLASS A again was sub-divided into—

(1) Birds which prey upon mice and rats, animals which are injurious to agriculture ; and

(2) Birds which eat insects as their natural food.

CLASS B was sub-divided thus :

(1) The so-called game birds.

(2) Other birds not ordinarily treated as game, but the flesh of which is eaten by certain castes.

Birds of CLASS A he proposed to protect at all seasons of the year : of CLASS B only during the breeding season.

In submitting these lists, Mr. Thompson remarked that he had followed Jerdon's nomenclature, as Jerdon's works were to be found in all District libraries. He also pointed out that in the Central Provinces the natives were singularly indiscriminating in their nomenclature of birds—and had indeed no terms at all to denote many species. Mr. Thompson added that his lists did not pretend to scientific accuracy, as his object was entirely practical.

3. The lists were returned to Mr. Thompson with some criticisms and suggestions by Mr. Fuller, Commissioner of Settlements and Agriculture, and Mr. Thompson was asked to revise and settle them, and also to report on the proper close seasons for those Mammals which ought to be protected.

4. Mr. Thompson has now submitted four lists as follows :—

A.—A list of the more common Insect-eating birds of the Central Provinces.

This list comprises :—

Systematic name.	(1) Vernacular name. (2) Common English name.	Brief note of habitat.	Breeding season (close season).
1. *Swallows and Swifts.*			
Hirundo rustica ……	Abahil. Common Swallow.	All three swallows are permanent inhabitants of wooded and hilly districts of the Central Provinces.	From March to October, according to locality.
,, filifera ……	Abahil. Leishra. Wire-tailed Swallow.		
,, daurica……	Abahil. Red-rumped Swallow.		
Cotyle sinensis ……	Abali. Bank Martin. .	Lives in the vicinity of sandy rivers and nallas.	From November to June.
,, concolor …..	Abali. Crag Martin .	Rare. Hilly and wooded districts.	

Systematic name.	(1) Vernacular name. (2) Common English name.	Brief note of habitat.	Breeding season (close season).
Cypselus affinis	Ababil, Bubila. Indian Swift.	Common everywhere, nesting within buildings.	Throughout the year.
,, batassiensis	Tari-Ababil. Palm Swift.	Only where the toddy palm is found.	From November to June.
Dendrochelidon coronata.	—— Crested Tree-Swift.	In open forests.	
2. *Night-Jars or Goat-Suckers.*			
Caprimulgus indicus	Jungle Night-Jar ...	The Night-Jars occur in all the forests and well-wooded districts in the Central Provinces. They also occur, sometimes, as garden visitors in such open country as that surrounding Raipur and Nagpur.	From November to June.
,, albonotatus	Dubki. Large Night-Jar.		
,, asiaticus ...	Chippak. Lesser Night-Jar.		
,, monticolus.	,, Franklin's Night-Jar.		
3. *Bee-Eaters.*			
Merops viridis........	Patunga. Common Bee-Eater.	Throughout the Central Provinces.	From November to June.
Merops philippensis .	Burra Patunga. ,,	Larger sandy rivers.	From February to July.
4. *King-Fishers.*			
Halcyon fuscus	Kil-killa. Kingfisher.	Throughout the Central Provinces. Much sought after for its skin and feathers.	From February to July.
5. *Woodpeckers.*			
Picus mahrattensis...	All Woodpeckers are known to natives under one general name, *Lakarphor, i.e.*, woodsplitter.	The Woodpeckers inhabit the whole of the wooded and hilly tracts in the Central Provinces. Several occur in gardens and in the avenues of trees planted on road sides.	From February to August, according to locality.
Yungipicus Hardwickii.			
Chrysocolaptes sultaneus.			
,, goensis.			
Gecinus striolatus ...			
Brachypterus aurantius.			
,, chrysonotus.			
,, dilutus			
Yunx torquilla			Cold season visitor.

Systematic name.	(1) Vernacular name. (2) Common English name.	Brief note of habitat.	Breeding season. (close season).
6. *Cuckoos.*			
Cuculus canorus ...	Kuphoo. Cuckoo. ...	Arrives in the Central Provinces during May, and departs during July.	From April to August according as their respective hosts breed.
,, microptera..	Kuphoo. ,, ...	Forest bird............	
Hierococcyx varius...	Papaya. ,, ...	In all wooded districts	
Polyphasia nigra......	....	Do.	
Surniculus dicruroides.	....	Forest bird	
Coccystes malanoleucos.	....	Wooded districts, not very common.	1st April to 31st October.
7. *Shrikes.*			
Lanius lahtora	Lahtora. Grey Shrike.	Open jungly districts.	1st February to 31st July.
,, erythronotus.	Lahtora. Rufous-backed Shrike.	Do.	
,, nigriceps	Lahtora. Black-headed Shrike.	Wet localities.	
,, Hardwickii...	Lahtora. Bay-backed Shrike.	Open jungly districts.	
,, cristatus	Lahtora. Crested Brown Shrike.	Winter visitor. Affects gardens and groves	Does not breed in the country.
Tephrodornis pondiceriana.	—— Wood Shrike.	Open jungly districts.	1st July to 31st October.
Volvocivera Sykesii..	Back-headed Cuckoo Shrike.	Do.	
Volvocivera melachistos.	Dark-grey Cuckoo-Shrike.	Open jungly districts.	1st July to 31st October.
Graucalus Macei......	Large Cuckoo-Shrike.	Do.	
8. *Minivets.*			
Pericrocotus speciosus.	Sahili. Large Minivet.	Forest bird.	1st March to 31st October.
,, peregrinus.	Sath-Sahili. Small Minivet.	Open jungles.	
Drongo Shrikes.			
Dicrurus macrocercus.	Bojanga. Common Drongo.	Open cultivated districts.	March to July.
,, cerulescens...	Pahari-Bojanga. White-bellied Drongo.	Wooded hilly localities.	
Edolius paradiseus ...	Bhimraj. Racket-tailed Drongo.	Forests	

Systematic name.	(1) Vernacular name. (2) Common English name.	Brief note of habitat.	Breeding season (close season).
10. *Fly-Catchers.*			
Tchitrea paradisi ...	Shah-Bulbul. Paradise Flycatcher.	Forests..................	May to September.
Myiagra azurea	Blue Fly-catcher.	Do.	
11. *Ground Thrushes.*			
Pitta bengalensis ...	Nourang. Yellow-breasted Ground Thrush.	Do.	May to September.
12. *Babbling Thrushes.*			
Malacocercus terricolor.	Sat-Bhaini. Goungai. Babbling Thrush.	Woods, gardens, and low jungle.	From April to December.
,, Malcolmi...	Goungai	Open jungly plains.	
13. *Starlings.*			
Sturnopastor contra..	Ablak. Ablaka Starling.	Moist, wooded localities.	From May to November.
Acridotheres tristis...	Maina. Dudhi. Starling.	Spread throughout the country.	
14. *Sparrows.*			
Passer indicus.........	Gouriya. Sparrow ...	Common house sparrow.	All seasons.
,, flavicollis......	Jungly Gouriya.......	Jungly districts, breeds in trees.	March to July.

Mr. Thompson furnishes the following *note* upon List **A** :—

The more prominent species have been selected for preservation. The Raptorial birds have been excluded from the list; because—1*st*, the majority of the species are only visitors during the cool season ; 2*nd*, they are rarely or never shot ; and 3*rd*, those species which breed in the country are rarely even molested.

A large number of insectivorous birds, which breed in the forests of these Provinces, have also been omitted from the list, as their protection during the breeding season, and at all times, can be best secured by the action of the Forest Department. These birds are the Forester's friends.

In the list the breeding season with dates is given. A few birds, such as starlings, swallows, and sparrows are trapped and eaten by the lower-caste Hindus and aborigines, but the great majority of the birds whose names appear in the list enjoy a certain immunity from their human enemies. The protection of all the birds given in the list should not be confined to the breeding season alone. Such birds are useful adjuncts to all agricultural and arboricultural operations and to the growing crops, and ought therefore to be permanently protected for the services which they thus render.

I have not attempted, in any of the lists now submitted, to quote any authority for the dates of the breeding season. The reason why authorities, whose notes are available to the reading public, vary so much in their dates for the breeding season, is because the ruling factors which govern the breeding seasons are both heat and moisture together, which mean abundance of food at those seasons. But as these factors vary with the varying conditions imposed on a locality by its geographical position, topographical features, and general environment, so also do the breeding seasons vary in their periods of times according to locality. Hence what is true as regards a given locality or tract of country, may not be true for another tract of country differently localised.

The dates which I have ventured to insert in the lists have been acquired by personal observation, continued and corrected by a residence of more than twenty years in these Provinces. For the dates of breeding seasons given in the accompanying lists I am solely responsible.

A kingfisher (*Halcyon fuscus*) has been introduced in List **A**. But the fact is that the habitual food of this kingfisher consists of lizards, mice, crabs, and a few insects. This bird is, however, trapped and killed for the sake of its feathers in ever-increasing numbers everywhere in these Provinces, and unless speedy protection is afforded to it, this kingfisher is certain to disappear from the living *fauna* of the country. It has already, during the course of the last 20 years, become extremely rare in the Southern, Western and Eastern districts of the Central Provinces. It is in these districts that the operations of the professional bird-catchers have been and are still being carried out with fatal effect against this bird. I therefore venture to hope that any measure now introduced for its protection is justified for reasons above given.

B.—A List of Game Birds which breed in the Central Provinces.

Systematic name.	Vernacular name.	Brief note of habitat.	Breeding season (close season).
1. *Sand-Grouse.*			
Pterocles fasciatus...	Bhut-titur. Dongur-kouri.	Low jungle and rocky hills.	1st October to 31st May.
,, exustus ...	Bhut-titur	Open wastes and cultivated plains......	
2. *Pea-Fowl.*			
Pavo cristatus	Mor Munjur	Forest bird............	1st March to 30th November.

Systematic name.	Vernacular name.	Brief note of habitat.	Breeding season (close season).
3. *Jungle-Fowl.*			
Gallus ferrugineus ...	Jungly Murghi	Forest bird. Eastern portions of the Central Provinces.	1st March to 30th November.
,, Sonneratii ...	Jungly Murghi	Forest bird. Western portion of the Central Provinces.	
4. *Spur-Fowl.*			
Galloperdix spadiceus.	Choti Jungly Murghi...	Forest bird. Thick jungles and low hills.	1st March to 31st November.
,, lunulatus.	Choti Jungly Murghi...	Forest bird. Bambu thickets.	
5. *Partridge.*			
Francolinus vulgaris.	Kala titur	Eastern and Northern portions of Sambulpur only.	1st June to 30th November.
,, pictus...	Kala titur	Well distributed in open jungles and grassy glades.	
Ortygornis pondiceriana.	Gora titur	Low jungle round cultivation. Live hedges.	1st January to 30th June.
6. *Quail.*			
Coturnix coromandelica.	Chinuk	Grass plains	1st May to 30th November.
7. *Bush-Quail.*			
Perdicula argoonda. .	Lawa	Rocky wastes.	1st May to 30th November.
,, asiatica ...	Lawa	Jungle bird...........	
Microperdix blewitti.	Sirsi-Lawa	Grassy glades in heavy forests near water.	
8. *Bustard-Quail.*			
Turnix pugnax	Gundru	Jungly wastes.........	1st May to 30th November.
,, joudera	Gundru	Do.	
,, dussumieri ...	Tura-Dubki............	Grass plains	
9. *Bustard.*			
Eupoditis Edwardsii.	Hoom-Tokdur	Wide rolling plains near hills.	1st May to 30th November.

Systematic name.	Vernacular name.	Brief note of habitat.	Breeding season (close season).
10. *Lik-Florikan.*			
Sypheotides aurita...	Tun-Mor..............	Grass plains	1st May to 30th November.
11. *Spurred-Goose.*			
Sarkidiornis melanonotus.	Nukta	Tanks and jheels. Breeds in trees.	1st June to 30th November.
12. *Goose-Teal.*			
Nettapus coromandelianus.	Girja	Do. do. ...	1st June to 30th November.
13. *Whistling-Teal.*			
Dendrocygna arcuata	Silli	Do. do. ...	1st June to 30th November.
14. *Grey-Duck.*			
Anas pœkilorhyncha.	Garmpai	Tanks and jheels in wooded districts.	1st June to 30th November.

The following is Mr. Thomson's *note* on List B :—

The list includes all the recognized game birds which breed in the Central Provinces. It does not include the only snipe that breeds in the country—namely, the "Painted Snipe," which can scarcely be considered a game bird. Nor does it include the Plovers and Lapwings for the same reason.

The close season for the game birds will be the periods embraced within the dates specified for dates of breeding season. Game birds which do not breed in the country and only visit it during the cool season are omitted altogether from the list.

The authority for dates of breeding seasons given in the list rests on my personal observations, and for these I am solely responsible.

C.—A List of other than Game Birds which breed in the Central Provinces whose flesh is largely eaten by certain castes and tribes.

Systematic name.	Vernacular name	Brief note of habitat.	Breeding season. (close season)
1. *Green Pigeon.*			
Crocopus phœnicopterus.	Harrial ...	Forests and wooded districts, feeding on various wild fruits.	1st February to 31st July.
„ chlorigaster...	Harrial ...		
2. *Blue Rock Pigeon.*			
Columba intermedia.	Kabutur	Haunt large buildings, such as churches, mosques, tombs, old forts and the like, and also large solitary trees. Of wide distribution.	1st November to 30th June.
3. *Doves.*			
Turtur meena	Kulla fachta ...	Mountain forests. Elevation above sea level 1,500 to 2,000 feet.	1st May to 31st July.
„ cambayensis ..	Tortru fachta ..	Cultivated and populous districts; also jungles.	1st November to 31st May.
„ suratensis......	Chitroka fachta ...	Do. do.	
„ risorius.........	Dhor fachta ...	Do. do.	
„ senegalensis...	Seroti fachta ...	Do. do.	1st February to 31st July.
4. *Herons and Egrets.*			
Ardea cinerea ...	Kabud	Tanks and marshes.	1st June to 31st October.
„ purpurea ...	Nari	Do.	
Herodias alba ...	Burra bugla... ...	Do.; also river banks.	
„ egrettoides.	Sufed bugla... ...	Tanks, marshes and river banks.	
„ garzetta ...	Choti sufed bugla ...	Do.	
Buphus coromandus.	Gai bugla	Usually found in company with grazing cattle.	

Mr. Thompson *notes* as follows on this list :—

This list includes the more common birds usually sought for because of their flesh being esteemed as food by a large portion of the population of these Provinces. The flesh of Herons and Egrets is largely eaten. But there has arisen within the last few years an ever-increasing demand for the plumes with which these birds are adorned *during their breeding season only.* Hence the wholesale destruction of these birds by the professional Shikaris and bird-catchers at the breeding season, can only end in the total extinction of these birds. As far as this wholesale destruction has yet extended, the birds within those areas are practically extinct.

The close season for these birds is specified in the list opposite the name of the species in the column headed " Breeding season."

D.—A List of the Game Mammalia which breed in the Central Provinces and of mammals the flesh of which is largely eaten by certain castes and tribes.

Systematic name.	Vernacular name.	Brief note of habitat.	Breeding season (close season).
1. *Hare.*			
Lepus nigricollis ...	Khurgosh. Sassa Lumkunni. Bhuttali.	Low thin jungles. Widely distributed.	1st November to 30th April.
2. *Pig.*			
Sus indicus..........	Soor—Burhah	Jungles, ravines and grass birs.	1st July to 30th November.
3. *Deer.*			
Rucervus duvaucellii.	Gouni—Barasingha...	Sal jungles with heavy grass covered glades.	1st July to 1st March.
Rusa aristotelis	Sambur	Heavy forests. Hills and mountains.	
Axis maculatus	Chitul	Open jungles in river valleys.	
Cervulus aureus	Kotri. Bhursaha ...	Heavy forests. Hills and mountains.	
Meminna indica......	Mugi—Turi	Heavy forests. Specially partial to sal and bambu forests.	
4. *Antelope.*			
Portax pictus	Nilgai. Roze	Thin open jungles.	1st July to 1st March.
Petraceros quadricornis.	Bherki. Chousingha	Ditto.	
Antilope bezeartica...	Kala Hirun............	Open plains.	
Gazella bennettii ...	Chin Karra...........	Thin open jungles, with ravines and nallas intersecting the ground.	
5. *Gour or Bison.*			
Gavœus gaurus	Gaur	Heavy tree and bambu forests on hills and mountains.	1st August to 1st March.
6. *Buffalo.*			
Bubalus arni	Ban-bhaisa	Open thin jungles. In the Eastern districts of the Central Provinces.	1st August to 1st March.

The *note* is as follows:—

This is a complete list of the mammalia usually denominated "game." It includes the Hare, Pig, Deer, Antelope, Gaur, and Wild Buffalo.

The dates for the close season set opposite to the names of each species applies only to the Hinds, Does, females, and their young. The males require no close season except as regards antlered deer. In their case a close season is necessary for the full development of the horns, which are usually shed and renewed once a year.

I would therefore venture to propose the following dates for the close season of such deer:—

Stags	Gonni	1st May to 31st October.
	Sambur	1st April to 31st October.
Stag	Chitul	1st September to 1st March.

It is during the above given periods that the majority of the stags shed and renew their horns. The periods during which the stags are in their best condition for sport are, as regards the—

Gonni or Barasingha—between the 1st November and the 30th April: about this latter date stags which have shed their horns may frequently be seen.

Sambur—between the 1st November and the end of February; after which date they begin to shed their horns.

Chitul—between the 1st March and the 15th August; after which latter date the stags which are worth shooting begin to shed their horns.

I would also venture to suggest that all Shooting Licenses given out under the Rules recently framed under the Forest Act, have now a close season for the antlered deer inserted as a condition to be observed by sportsmen. And also that the shooting or killing in any way the Hinds, Does, females and their young, of any species specified in the List D be strictly prohibited to sportsmen taking out Shooting Licenses in the Government Reserved Forests.

5. It appears to the Chief Commissioner that what is required is to prevent the slaughter of insectivorous birds at all times and to allow the slaughter of game and edible birds at any save the close season. Subject to further consideration hereafter, Mr. Mackenzie proposes to protect absolutely Herons and Egrets, which are only eaten by a few low castes, and which are destroyed solely for the sake of their plumage, and that chiefly at the breeding season.

Mr. Thompson's lists do not refer to migratory birds, chiefly of the water and marsh or shore varieties which visit these Provinces only in the cold weather. There is of course no necessity for protecting these, and this will be made clear in the orders issued.

6. As regards mammals, the Chief Commissioner does not propose to protect 'pig,' which is extremely mischievous to crops, nor does he think it worth while to protect hare. In the case of deer and antelope, though Mr. Thompson would allow the shooting of does and hinds at times other than the close season, the Chief Commissioner proposes for the present to protect the females and fawns of

these species throughout the year. They have been shot down of late years in such numbers by sportsmen (not only native, but European) that it will be well for a time at least to stop their destruction. The close season for stags of antlered deer and antelope will be as suggested by Mr. Thompson.

7. For the terms of the close seasons, the Chief Commissioner accepts provisionally Mr. Thompson's suggestions, in which Colonel Doveton concurs,—although perhaps in some instances extreme limits have been taken. There is nothing regarding which more differences of opinion are to be found, and the Chief Commissioner will be glad to receive suggestions and information from naturalists and sportsmen with a view to the improvement of the lists in this and other directions.

8. The orders which the Chief Commissioner has decided to issue are set forth in Notifications Nos. 7493 and 7494 of this date. These Notifications supersede incomplete Notifications bearing the same numbers, which were prematurely published in the *Central Provinces Gazette* of the 21st December, 1889, before the Chief Commissioner's final orders had been received from camp. The Rules under the Arms Act do not affect European sportsmen shooting outside the Government Forests, but it is hoped that all true sportsmen will conform to them.

L. K. LAURIE,
Offg. Secretary.

NOTIFICATION.

Dated Nagpur, the 3rd January, 1890.

No. 7493.—The Chief Commissioner is pleased to make the following Rules, under Section 25 (i) of Act VII. of 1878 (the Indian Forest Act), in continuation of those published in *Central Provinces Gazette* Notifications No. 6925, dated the 29th November, 1888, No. 1505, dated the 8th March, 1889, and No. 7313, dated 11th December, 1889, and in supersession of those contained in Notification No. 7493, published in the *Central Provinces Gazette* of the 21st December, 1889:—

XI.—Independently of any restrictions made under Rule II, clause (2), a permit issued under these Rules does not authorise the destruction of any kind of *Birds*, other than the game and edible birds included in the following list —

SYSTEMATIC NAME.	VERNACULAR NAME.
1. *Sand Grouse,*	
Pterocles fasciatus ...	... Bhut-titur. Dongar-kouri.
,, exustus ...	... Bhut-titur.
2 *Pea-fowl.*	
Pavo cristatus ...	... Mor Munjur.
3. *Jungle-fowl.*	
Gallus ferrugineus	... Jungly Murghi.
,, sonneratii ...	... Do.
4. *Spur-fowl.*	
Galloperdix spadiceus	... Choti Jungly Murghi.
,, lunulatus	... Do. do.

5.	*Partridge.*	
	Francolinus vulgaris	Kala titur.
	,, pictus	Do.
	Ortygornis pondiceriana	Gora titur.
6.	*Quail.*	
	Coturnix coromandelica	Chinuk.
7.	*Bush-Quail.*	
	Perdicula argoonda	Lawa.
	,, asiatica	Do.
	Microperdix blewitti	Sirsi Lawa.
8.	*Bustard-Quail.*	
	Turnix pugnax	Gundru.
	,, joudera	Do.
	,, dussumieri	Tura Dubki.
9.	*Bustard.*	
	Eupoditis Edwardsii	Hoom Tokdur.
10.	*Lik Florikan.*	
	Siypheotides aurita	Tun-Mor.
11.	*Spurred-Goose.*	
	Sarkidiornis melanonotus	Nukt.
12.	*Goose Teal.*	
	Nettapus coromandelianus.	Girja.
13.	*Whistling Teal.*	
	Dendrocygna arcuata	Silli.
14.	*Grey Duck.*	
	Anas pœkilorhyncha	Garmpai.
15.	*Green Pigeon.*	
	Crocopus phœnicopterus	Harrial.
	,, chlorigaster	Do.
16.	*Blue Rock Pigeon.*	
	Columba intermedia	Kabutur.
17.	*Doves.*	
	Turtur meena	Kulla fachta.
	,, cambayensis	Tortru fachta.
	,, suratensis	Chitroka fachta.
	,, risorius	Dhor fachta.
	,, senegalensi	Seroti fachta.
18.	Migratory marsh and water birds, such as duck, teal, snipe, &c., which do not breed in these Provinces and visit them in the cold season only.	

XII.—With reference to clause (3) of Rule II, destruction of birds of the species named in Rule XI. and of deer and antelope is prohibited *during the close season*, the term of which is fixed as follows:—

For		*Close Season.*
1.	Sand-grouse	1st October to 31st May.
2.	Pea-fowl	1st March to 30th November.
3.	Jungle-fowl	Do. do.
4.	Spur-fowl	Do. do.
5.	Partridge—	
	Francolinus vulgaris ,, pictus	1st June to 30th November.
	Ortygornis pondiceriana	1st January to 30th June.

6.	Quail	1st May to 30th November.
7.	Bush-Quail	Do. do.
8.	Bustard-Quail	Do. do.
9.	Bustard	Do. do.
10.	Lik-Florikan	Do. do.
11.	Spurred Goose	1st June to 30th November.
12.	Goose Teal	Do. do.
13.	Whistling Teal	Do. do.
14.	Grey Duck	Do. do.
15.	Green Pigeon	1st February to 31st July.
16.	Blue Rock Pigeon	1st November to 30th June.
17.	Doves—	
	Turtur meena	1st February to 31st July.
	,, cambayensis ...	1st November to 31st May.
	,, suratensis... ...	
	,, risorius	
	,, senegalensis ...	
18.	Deer and Antelope—	
	Does, Hinds and Fawns...	The whole year.
	Stags ... Gouni ...	1st May to 31st October.
	Sambur ...	1st April to 31st October.
	Chitul ...	1st September to 1st March.

L. K. LAURIE,

Offg. Secretary.

REVIEWS OF NEW BOOKS.

"THE REPTILIA AND BATRACHIA OF INDIA."*

"The Reptilia and Batrachia of India," in the vulgar tongue, its reptiles and frogs. This is the fourth complete volume that has appeared of the series of handbooks of Indian Natural History published under the title of the "Fauna of British India, including Ceylon and Burmah," by authority of the Secretary of State for India, and under the editorship of W. T. Blanford. In one sense this was more wanted than any other volume of the series, for the student of Indian snakes, lizards, and frogs has been dependent hitherto on Dr. Gunther's great quarto, published in 1864, and Theobald's descriptive catalogue, both of which, we believe, have long been out of print. How much has been done since these books were written may be judged by the fact that the work now under review describes 130 lizards, 82 snakes, and 187 frogs more than Gunther's work, and 52 lizards and 39 snakes more than Theobald's catalogue. And yet, if this book gives anything like the stimulus it should to the observation and collection of reptiles in this country, it will itself be out of date in a few years. Within the last year *Trimeresurus trigonocephalus*, a poisonous snake, described in its pages as an inhabitant of Ceylon, has been obtained by our Natural History Society from North Canara, and we have not a doubt that many other rare species will be found in regions which they are not now supposed to inhabit. In committing this work to Mr. Boulenger, of the British Museum, we must assume that those concerned were making the best choice in their power. Mr. Boulenger, we learn from the preface, has been engaged for the last eight years in classifying and describing all known species of crocodiles, tortoises, lizards, chameleons and batrachians in catalogues of the British Museum. But, unfortunately, he does not appear ever to have been in India. The book has exactly the merits and the defects which might have been anticipated from these circumstances. Of cobras, tree-frogs, monitors, and geckos, as they present themselves in spirits of wine, we have a most discriminating and without doubt a most accurate account; but we are almost led to forget that they ever presented themselves in the flesh at all. Rarely do we meet with even an allusion to the habits of the living animal. Even those strange habits which illustrate the most striking peculiarities of structures are severely unnoticed. Here is a description of the tongue of the chameleon:—" Tongue cylindrical, extremely extensile and projectile, sheathed at the base, club-shaped and viscous at the end, with an exceedingly elongate, glosso-hyal bone." This is most admirable, but nowhere do we find even an allusion to the purpose for which the creature is provided with this strange organ, so extensile and projectile and club-shaped and viscous at the end. Again we are told that *Draco* possesses " a large, lateral, wing-like membrane, folding like a fan, supported by the last five or six ribs, which are much produced." Does Mr. Boulenger not know that the *Dracones* are flying lizards, or does he consider the circumstance too trivial to mention? These two instances illustrate the whole book. Lizards, snakes, and frogs follow each other in even rows, as they did on the shelves of the British Museum, where Mr. Boulenger examined them, easily distinguishable by their labels to those who know what the labels mean. Add to this that the book is very sparingly illustrated, and it will readily be guessed that it is not calculated to be generally interesting. To curators of museums and professors of biology we are quite sure it will be very useful; indeed, we may go further and say that anyone who betakes himself to the study of reptiles, with the dissecting knife in hand and a large collection of specimens at his command for comparative purposes, will find it an admirable guide. But the number of such persons in India is very small, while the number of men who take an intelligent interest in living creatures and wish to be able to identify those species of beasts, birds, and reptiles which come under their observation is comparatively large and has increased rapidly of late years, and we imagine that it was to meet the needs of the latter class and so promote the study of Indian Fauna that the publication of this series was undertaken. And we must candidly say that this class will not find the book by any means stimulating, or even so helpful as it might have been. If this is the result of editorial "compression," then Mr. Boulenger has our sympathy, for he has been squeezed much drier than Dr. Day or Mr. Oates. But we are more disposed to think that we see in this book nothing but the natural result of those eight years spent at the treadmill of catalogue-making in the British Museum. We have yet one fault to find with the book, for which both author and editor must be held responsible, and that is the want of a glossary of technical terms. There is no attempt at such a thing. There are indeed some diagrams of skeletons, in which the names of the different bones are given, but these are troublesome to refer to and quite insufficient. Let us take a few examples. We are studying the frogs, and read that the *Ranidæ* may be distinguished from the *Engystomidæ* by the dilation of the Diapophyses of the sacral vertebræ. A tolerably liberal education has left us still ignorant of the precise nature of a Diapophysis; we turn to the diagram in vain; we must evolve it from our inner consciousness. Further on we meet with Zygapophyses, Choanæ, Canthus Rostralis and many more. A glossary explaining all these would scarcely have added two leaves to the bulk of the book, and might have survived the severest compression. So much for the faults of the book. As we said, it has its merits, and they are solid ones. Beginning with the crocodiles, Mr. Boulenger describes three species only, regarding *Porosus* and *Pondicerianus* as the same. This species, he says, has not been recorded from the west coast of India. Our Mugger is *C. Palustris*. The third is of course the Gavial, *Gavialis gangeticus*, of which he remarks that it feeds entirely on fish, for seizing which its narrow jaws are specially adapted. This is certainly the generally received opinion, but what of that specimen whose gigantic skeleton adorns the Victoria and Albert Museum, which was shot while feeding on the body of a woman? A number of bangles and other ornaments, said to have been found in its stomach, used to be exhibited in a bottle beside it, but some visitor thought he could put them to a better use than the gratification of idle curiosity, and they disappeared. Passing on to the tortoises and turtles, the author describes 44 species, of which the "soup" turtle, the fresh water tortoise, which natives are so fond of introducing into our wells, and the land tortoise, found commonly in Guzerat, are probably the only ones that most of us have seen. The majority inhabit the Burmese region. The lizards, numbering 222 species, come next, and are divided into eight families, four of which contain familiar forms, the *Geckonidæ*, or house Geckos, the *Agamidæ*, to which belongs the garden "bloodsucker," the *Varanidæ*, or monitors, and the *Scincidæ* or skinks, of which one species at least often steals into our houses, with its gentle, snake-like motion, in search of ants and other insects. The classification of the snakes in this volume is new, and though we cannot but think that the worst system of classification would be better than the licence which in these days permits any man who writes a book to remove all ancient landmarks and become his own Linnæus, we must admit that the changes introduced by Mr. Boulenger are in the right direction. He does not multiply, but reduces sub-division. He abandons the old division of snakes into venomous and non-venomous, rightly considering it unscientific. The poison fang is in truth only a modification of a common tooth, and that modification is carried to various degrees, reaching perfection in the long, erectile and perforated fang of the vipers. The fang of a cobra is a much less finished instrument, but, for practical purposes, efficient, as we know. In other snakes, though the apparatus in an elementary form, is there, it is only fitted to paralyse the small animals on which they feed, and these we pronounce harmless. Mr. Boulenger calls them "suspected," and our readers will be shocked to learn that *Dryophis mycterizans*, the slender, green whip snake, whose gentle ways charm the most uncompromising serpent-hater, is a hypocrite and belongs to this class. Of distinctly poisonous land snakes 34 species are enumerated, but many of these are only found in the Burmese region, and others are too small to be dangerous to man. In this Presidency there are only seven or eight, which can really be regarded as dangerous, and among these there are only four which anybody is likely to have a chance of seeing unless he searches for them diligently, namely, the cobra, Russell's viper, the Krait (*Bungarus cœruleus*), and the abominable little carpet-snake (*Echis carinata*). The sea-snakes, which number 27 species, are all venomous; but they are as helpless on land as a piece of string, and in the water it must be a very curious accident which can put a man in the way of being bitten by them. As far as we know there is no case on record of death from the bite of a sea-snake.

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* "The Fauna of British India, including Ceylon and Burmah," published under the authority of the Secretary of State for India. Edited by W. T. Blanford. REPTILIA and BATRACHIA, by George A. Boulenger. London: Taylor and Francis, Red Lion Court, Fleet Street; Calcutta: Thacker, Spink and Co.; Bombay: Thacker and Co., Ld.; Berlin: R. Friedländer and Sohn, 11, Carlstrasse.

We have said that the classification of snakes of this book is new. It follows, that many well known names have disappeared, and new ones have come in their places. The king cobra is not *Ophiophagus elaps*, but *Naia bungarus*, there being no good reason for putting it into a different genus from its younger brother. So also our familiar friend—or enemy—*Daboia elegans*, has become *Vipera russellii*. The book closes with the frogs, toads, and newts. There is only one newt, but there are 102 frogs and 17 toads, so completely have the No's carried the day in the question of tails or no tails. We have complained of the paucity of notes on habits, but among the frogs we light upon one too many. After describing *Rana tigrina*, our great bullfrog, whose joyous bassoon celebrates the advent of the monsoon, the author says: "It is essentially aquatic, and is said, when frightened, to jump over the surface of the water much in the same way as on land." The editor corrects this statement, and indeed no one who had seen the great frog at home could have made it. Even to say that he is essentially aquatic is incorrect. He inhabits tanks and marshes, but stays about their margins, and is more out of the water than in it. He wanders freely about the garden in wet weather, and lies in wait for tender chickens, which he will catch and swallow without much caring whether you believe it or not. When he falls into a well he lives a very unhappy life, for he cannot float with comfort. His legs hang down, and only his nose remains above the surface. He is quite incapable of the feat attributed to him by Mr. Boulenger, which is characteristic of one or two species much smaller in size and aquatic in a stricter sense. They live almost entirely in deep water, floating at the surface with perfect ease, and living chiefly on the insects that fall into the water. Fishing for these with a rod and line is very good sport. A hook is not necessary. The bait, consisting of a grasshopper, or any tough insect, may be tied to the line and trailed along the surface, past the nose of the frog, who will seize and bolt it at once. He must be whipped out of the water without delay, for the line tickles the lips, and after one or two efforts to wipe it off with his paws, he will disgorge the bait. We must close this notice now, and wish Mr. Boulenger an early call for a second edition, that he may have an opportunity of putting flesh on the dry bones and making his book an invaluable addition to the too small library of an Indian Naturalist. Of the print and get-up of the book we need say nothing. It is the same as the other of the series.—*(Times of India, Dec. 2, 1890.)*

HUME'S INDIAN OOLOGY.

The history of this valuable re-issue of Hume's "Nests and Eggs" is told by the author and the editor in the prefaces prefixed to the volume now issued. Mr. Allan Hume, whose unrivalled collection of Indian birds is now safely deposited in the national collection, states that after the first rough draft appeared, he went on laboriously accumulating materials for a re-issue; these have been now placed by him in the hands of Mr. Eugene Oates for publication. Unfortunately, however, not the whole of this store of knowledge was available, for on one occasion, during Mr. Hume's absence from Simla, a native servant broke into his museum and stole several hundredweights of manuscript which the unappreciative thief sold as waste paper. This MSS., bemoans the author, included the life histories of no less than 700 species of birds, with detailed accounts of their nidification. All the small slips of paper, writes the bereaved author, were left, but the full-sized sheets were abstracted. In this dilemma Mr. Oates came to the aid of the author, not merely arranging the materials as editor, but adding largely to the text from his own stores of knowledge. As the historian of the Birds of India, a work which has recently been the subject of detailed notice in our columns by Mr. Bowdler Sharpe, Mr. Oates was the fittest person to supervise the publication of the work under notice; and Mr. Hume states that he knows of no one else to whom he could have entrusted the task. The manuscript has been placed unreservedly in the editor's hands, who has re-arranged the species so as to accord with his own work in the official Fauna of British India. The classification is not on the system adopted by Jerdon and other writers familiar to Indian ornithologists, but as the deposition of the old arrangement was merely a question of time, Mr. Oates rightly regarded the present as a convenient opportunity, and adopted an arrangement better suited to the present state of scientific knowledge.

In the "Fauna of British India" the restriction of space necessarily submitted to by Mr. Oates has rendered his work less full of details than Jerdon's; but the publication of the present volumes supplies the deficiency in great part, as most interesting details of the habits, &c, of the species are given. As an example of the readable manner in which scientific information can be conveyed, the following extract which bears strongly on the questions recently raised in our columns on the breeding of polygamous birds is most interesting. Writing of the King Crow, or Black Drongo, *Decruris ater*, Mr. Hume says :—

"Of this bird we have already taken during the last six weeks at least fifty nests, and in many cases where we had left the empty nest in *statu quo*, we found it a week later with a fresh batch of eggs laid therein. Many birds will never return to a nest which has once been robbed, but the others, like the King Crow and the Little Shrike (*Lanius villatus*), will continue laying even after the nest has been cleared of perhaps four slightly incubated eggs; a fresh one that otherwise would assuredly never have seen the light is laid, and that, too, a fertile egg, which, if not meddled with, will be hatched off in due course. It might be supposed that, immediately on discovering their loss, nature urged the birds to new intercourse, the result of which was the fertile egg, and this in some cases is probably really the case, martins and others of the swallow kind being often to be seen busy with 'love's pleasing labour' before their eggs have been well stowed away by the collector. But this will not account for instances that I have observed of birds in confinement, who separated from the male before they have laid the full number, and then later, just when they began to sit, deprived of their eggs, straightway laid a second set, neither so large nor so well coloured as the first, but still fertile eggs that were duly hatched. But for the removal of the first set these subsequent eggs would never have been developed or laid. Now the theory has always been that the contact of the sperm and germ cells causes the development and fertilization of the latter. In these cases no fresh accession of sperm cells was possible, and hence it would seem as if in some birds the female organs were able to store up living sperm cells, which only work to fertilize and develope ova in the event of some accident rendering it necessary, and which otherwise ultimately lose vitality and pass away without action."

Regarding the vexed question as to whether birds ever leave their eggs to be hatched by the heat of the sun, Mr. Hume has some very interesting experience to relate. Writing of the common Myna (*Acridotheres tristis*), Mr. Hume described the building of a nest in a hole in a wall of his verandah, stating that the pair seemed present at all hours of the day. He then goes on to state :

"I made certain that they had not even begun to sit, and behold, there were four fine young ones, a full week old, chirping in the nest! Clearly these birds are not close sitters down here ; but I well remember a pair at Mussoorie, some 6,000 feet above the level of the sea, the most exemplary parents, one or other being on the eggs at all hours of the day and night. The morning's sun beats full upon the wall, in the inner side of which the entrance to the nest is; the nest itself is within four inches of the exterior surface; at 11 o'clock the thermometer gave 98° as its temperature. I have often observed in the river terns (*Seena aurantia, Rhynchops albicollis, Sterna javanica*) and pratincoles (*Glareo lactea*) who lay their eggs in bare white glittering river sands that so long as the sun is high and the sand hot they rarely sit upon their eggs, though one or other of the parents constantly remain beside or hovering near and over them; but in the early morning, in somewhat cold and cloudy days, and as the night draws on, they are all close sitters. I suspect that instinct teaches birds that, when the natural temperature of the nest reaches a certain point, any addition of their body heat is unnecessary and this may explain why, during the hot days (when we alone noticed them), in this very hot hole, the parent mynas spent so little of their time in the nest whilst the process of hatching was going on."

That the scientific pursuit of ornithology is most interesting and engrossing all those who ever attempted to follow it are fully aware, and we can imagine no better relief to the tedium of a quite location in India than the possession and utilization of Hume's "Nests and Eggs of Indian Birds," and Oates's "Birds of British India."

It may interest our readers to know that four admirable autotypes are inserted in the text, being those of the well known ornithologists, Allan Hume, Brian Hodgson, the late Dr. Jerdon, and Colonel Tickell, whose writings were so familiar to the older readers of *The Field* over the *nom de plume* of "Ornithognomon."

(The above appeared in *The Field.*)

MISCELLANEOUS NOTES.

I.—CONCERNING THE PRESENCE OF THE *TARAXACUM OFFICINALE* IN THE NILGHERRIES.

In his "Flora of British India," Hooker says expressly about the *Taraxacum officinale*, Wigg. "It is remarkable that this common Himalayan plant should not be found in the Khasia or Nilgherry mountains, even as a garden escape."

Perhaps when the renowned botanist wrote those words, this plant did not grow in the Nilgherries. Be that as it may, I met it several times, both at Wellington and at Ootacamund, and a year and a half ago it could be found plentifully in the latter place. Its height is generally small. As this species is extremely variable, I do not see anything that could induce one to look upon the specimens of the Nilgherries as a new variety of the *Taraxacum officinale*.

F. H. LÉVEILLÉ.

Pondicherry, Feb., 1891.

II.—A VARIETY OF *BUTEA FRONDOSA.*

With the month of March the glory of the Pallas (*Butea frondosa*) is rapidly passing away. Before it disappears entirely I should like to bring to the notice of the Society a curious and beautiful sport of the tree which is to be occasionally seen in this neighbourhood. It is very rare, and I have personally seen only one tree in hundreds of miles travel, but I have heard that others exist. Instead of the dazzling blaze of orange with which we are all so familiar, this tree blossoms into a pale yellow. The basis of the petals are primrose yellow, and they shade off to a creamy tint on the edges and on their reverse sides. The corolla contrasts every beautifully with its rich olive-brown downy calyx. Except in the colour of the corolla, the tree seems to be in all respects precisely the same as the common Pallas. It is the first of the kind I have seen after 20 years' residence in India, and it is certainly very uncommon, for the books do not mention it.

I have six seedlings of last rains in my gardens from seeds reputed to have been gathered from a yellow tree.

H. T. OMMANNEY,

Bo. C. S.

Godhra, Panch Mahals, 1st March, 1891.

III.—HARPOONING CROCODILES.

Captain G. Sutton-Jones, of the Deoli Irregular Force, who is a keen sportsman, sends us an account of the method adopted by him of destroying crocodiles in village tanks. The presence of these loathsome reptiles in village tanks and reservoirs is, as far as we know, productive of nothing but evil, as they are most destructive to the fish and wild fowl, and not infrequently drag goats and even children into the water.

Captain Sutton-Jones writes as follows :—

"The rainfall in these parts being far below the average, the water in the tanks is clear, and in few instances more than eight feet in depth. I was accompanied by Captain Penrose, of my Regiment, our chief intention being to shoot in the neighbouring jungles, and we only spent an hour or two with the crocodiles in the morning and evening before and after shooting.

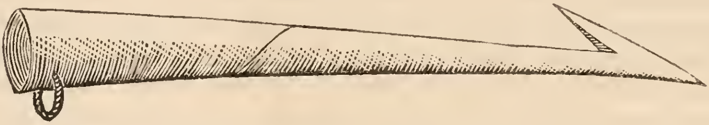
"The *modus operandi* was simple. Our harpoon had a movable head, with a ring at the end, to which about 50 yards of rope were attached and coiled neatly in the boat (a small flat-bottomed iron punt). The shaft of the harpoon was a well-seasoned bamboo about 10 feet in length. Our shikari was a man of the 'Keer' or fisherman caste, by name Gopala. One of us accompanied Gopala in the boat and punted quietly about the tank, carefully looking amongst the openings in the weeds for the crocodiles which we found lying at the bottom of the water in fancied security. It was an easy matter to drive the harpoon into the reptile and to withdraw the bamboo shaft It was then necessary to retreat quickly, as a pair of snapping jaws came up to the surface ready to seize anything.

While we punted away the crocodiles invariably brought about their own destruction, by entangling themselves in the weeds until they were unable to move. Finding that we could not haul them into the boat, we landed and dragged them out on to the shore, when a shot in the neck put an end to their misery.

"Occasionally the crocodiles would see the boat approaching them and make off as fast as they could along the bottom. It was most exciting work then punting after them. It frequently happened that as soon as we caught them up they would purposely stir up the mud at the bottom, so that we could not see them.

"We managed to get 18 crocodiles in this way, out of two tanks, but in no case did they exceed 9 feet in length. They were all the ordinary thick-snouted Crocodile or Muggur (*Crocodilus palustris*).

"The harpoon we used was of this description :—



"If it struck against the scales or plates on the back of the reptiles, the harpoon would not penetrate, but in no case did a crocodile succeed in getting off after the spear-head had once been well driven in near the hind or fore quarters."

IV.—A MAN-EATING PANTHER.

I BEG to forward three fingers of a boy of about 12 years of age, found in the stomach of a man-eating panther, shot on the 13th of last month. He was the only son of a Banjari woman, who with some 10 or 12 others, had put up in the open for the night, on her way to the Nizam's Dominions, in a tigerish-looking country, surrounded by hills covered with brushwood. It had rained a a little during the first part of the night, and the party did not, though fatigued after their journey, get to sleep till after midnight. Shortly after, the mother was disturbed by feeling the covering over her boy roughly dragged away, and, missing her son, who had gone to sleep by her side, raised an alarm, but the intense darkness of the night, and in absence of a light, rendered anything like a successful search impossible; and nothing remained for the poor mother, stunned with the horrible fear of what had happened, but to wait for the break of day, which, to her, came slowly indeed, and when it did come, afforded no relief, but brought with it the confirmation of her worst fears that her son had been carried off. Spots of blood here and there, and the marks on the grass of a heavy dragging of a body, simplified the tracking, that was taken up by a local shikarry; and in the dry bed of a small mountain stream, close by, the skull was found stripped of its flesh and hair. Further and further went the trail, until it ended, half way up a dark ravine, and at the foot of a large moha tree, and on its fork, five feet from the ground, they saw the coarse cloth, which the fond mother had tied round her child's neck, covered with blood. Looking up higher, the headless trunk of the unfortunate boy was seen balanced skilfully across a large bough, with the legs crossed, and one arm stiffly extended. The poor villagers frightened, not only at the awful occurrence, but by the skill shown in the disposal of the body, hastened to the District Officer's camp, which fortunately happened to be only five miles off. The appeal was unmistakeable, and it became a duty to respond to it. After a hurried breakfast, for which all appetite had been dissipated by the above sickening details, a move was made, and, true enough, the body, cloth and the ghastly remains of the boy were found in the exact position reported. A consultation with the native shikaries followed, as to the best means of getting a shot at the animal which had showed such extraordinary ingenuity, and which, it was expected, would be followed up in avoiding danger by exposing itself. The first essential was to so conceal oneself as to tempt it to come boldly up to the tree to take down its ghastly quarry. This was no easy matter, as the ground was rocky, and no natural cover available. However, by dint of hard labour, a small hole was dug, sufficient to hide in, and a covering of thorns was soon put up over my head, and in this cramped position, the brute had to be watched for from 5 p. m., till it got so dark that the trunk of the tree could not be distinguished. Reluctantlly a retreat was ordered, but before leaving, efforts were made to get the men to bring away the body, so as to prevent its being still further fed upon, but in vain. Neither money, nor threats, could conquer their superstition, that the spirit of the dead boy had already turned into an animal, and was acting in sympathy with the panther, and had warned him of the trap laid for him. As an alternative thorns were put to a considerable height all round the tree in the hope of preventing the panther from climbing up, but on visiting the place early in the morning, it was found that we had again been baffled. The thorns were pushed aside. The cloth and the body had both been removed. Tracks led further up the same ravine, and it was evident that the panther had taken up its abode there for the day. It was at once settled that we should beat it out and do our best to destroy it. Men were soon collected, and with drums beating they entered at one side, while the writer posted himself at the other. A third time we were out-generalled. An opening which was left by the cowardice of some men was availed of, and unseen by all, except one, the brute crossed an open glade at full speed and disappeared into another ravine. This time the duty of carefully posting men at all the outlets but one, was properly discharged, and the brute was driven straight ahead, but, somehow, kept out of my way. It looked as if it came to know that its safety lay in giving a wide berth to the gunner. Three times it thus dodged by doubling back, but the beaters were determined that it should give a chance, and drove it at last into a small ravine which could be and was completely hemmed in. Slowly and continually they descended, throwing stones until they actually reached the very bottom, and from their very feet up sprang the miserable creature, and still refusing the opening left to it, ran up the hill, and crossed the firer at a distance of 150 paces, as fast as it could go, offering a very difficult and uncertain shot. It had however to be accepted, as little of daylight remained, and fortunately the aim proved true, the bullet striking the neck, and turning it head over heels. A shout of joy burst forth from all, and the body was soon slung across a pole, and taken with acclamation to the village at which the tents were pitched. I was much struck by the resemblance of one of their exclamations to that mentioned by Meadows Taylor in the "Story of My Life." Repeatedly they shouted "Davies saheb ki jae." In passing through the village, the women turned out, each with a brass dish, furnished with a small lighted wick, red powder, and two pice. The first was waved over the dead animal, a pinch of the second affixed to its forehead, as also to that of the bystanders, and the third was given to one of the beaters. This ceremony was intended to lay the spirit of the deceased and to prevent its molesting them even after death. I had to decline with thanks the honor of my own forehead being painted with red powder. A *post-mortem* carefully made led to the finding of the accompanying three fingers of the unfortunate lad, who met his death in such a sudden and tragic manner. The discovery proved, beyond all doubt, that the slaughtered animal was the one we determined to get rid off, and avenge the bereaved mother, to whom, however, it was but a poor satisfaction, for nothing could console her for the loss of one so dear to her heart, and to whom she looked as the mainstay of her old age. It was the general opinion of these present that had the end not come as soon as it did, other victims by the score would have fallen to gratify an abnormal and an increasing appetite for human flesh. Already it had killed two persons, and severely mauled a third, within a period of two months. The panther had a very good coat, was a female, and in milk, and it seemed as if it had taken to kill human beings to supply its young ones with *tender* meat. The cubs we did not come across, and hope they were too young to walk, and have perished by starvation.

The theory above suggested, as to why the animal became a man-eater, is a new one, but is not without good reason.

It was noticed that the dogs of the villages within a 4 mile radius were frequently carried away, and when the supply diminished, a baby fell the first virtim—the door happening to be left open offered an opportunity which was not lost; then followed an attack on an elderly woman; and lastly the boy, who forms the subject of this narrative.

Basim, Berars,
24th March, 1891.

C. A. W. DAVIES,
Offg. Deputy Commissioner.

V.—THE CULTIVATION OF ORANGES, LEMONS, AND FIGS IN INDIA.

A.—Oranges.

Description of varieties.

(1.) The best orange grown for profit in India is the "Cintra," a name commonly assumed to be derived from the Portuguese town, but lately declared to be a corruption of a Sanskrit word, which should be pronounced "Suntra." The tree which bears this fruit is of upright habit, in this country rarely exceeding 12 feet in height and 8 feet in expansion of branches. The leaves measure $1\frac{1}{2} \times \frac{3}{4}$ inches and $2\frac{1}{2} \times 1\frac{1}{4}$ inches—the winged joint being very slightly developed. The flowers are $\frac{3}{4}$ inch in diameter, have 5 petals, 20 to 24 stamens, and 9 to 10 carpels. The fruit is found of two varieties, one, having the skin remarkably loose and evidently overgrown the pulp, and the other having a smooth, tight-fitting skin. As grown at Nágpur this has been declared by people, who have travelled much, to be the finest orange known in the world. The inner skin is very delicate, and the liths (carpels) so slightly cohering that it is easy to break up for eating. Well-grown specimens have only 2 or 3 seeds. The flavour of the two varieties is equal if grown under similar conditions, but the loose-skinned variety has an imposing appearance, and is rather more easily pealed; consequently it is the market favourite. Ordinary market specimens of the fruit average 8 ounces in weight, but 10-ounce specimens are common.

Other sorts grown in India.

(2.) The Mozambique orange *tree* is evidently a distinct species of strong growing habit, producing an irregularly globular head and bearing leaves measuring $2\frac{1}{4} \times 1\frac{1}{2}$ to $5\frac{1}{2} \times 3\frac{1}{4}$ inches, entire or very slightly and irregularly serrate, the apex being pointed or cut out. The leaf stalk is $\frac{3}{4}$ inch, the wings on one of the joints attaining $\frac{1}{4}$ inch in width, often less, and sometimes wanting. The flowers are $1\frac{1}{2}$ inches in diameter, have 5 slightly oblique petals which are glandular on the outside, and 20 to 24 stamens. Average specimens of the fruit grown in India weigh 8 ounces, but specimens 13 ounces in weight imported from Mozambique are common. In shape it is globular, slightly compressed vertically; the skin is medium in thickness, tight-fitting, and marked by numerous small vertical furrows and a circular smooth mark, about 1 inch in diameter, on the upper end: The pulp is usually pale yellow, but when dead ripe becomes of the brownish-yellow that may be called the medium tint of orange pulp. In flavour it is sweet, but without the piquancy of the best varieties; the inner skin (endocarp) is tough, so that this orange can only be sucked. They keep in good condition about two months.

Ladoo Orange of the Deccan.

The tree which bears this variety produces long branches apt to spread out considerably as the tree attains size. The leaves are from $1\frac{1}{2} \times \frac{3}{4}$ to $2\frac{1}{2} \times 1\frac{1}{4}$ inches, with the winged joint of the stalk very slightly developed. The open flowers are $\frac{3}{4}$ inch in diameter, of 5 petals, 20 to 24 stamens, and 9 to 10 carpels.

The fruit attains 8 ozs. in weight, is in shape a much depressed globe, with a distinct nipple at the stalk, and within the skin on the upper end generally has an extra orange, about $\frac{3}{4}$ inch in diameter, with 5 to 7 liths (carpels). The skin is of a dusky yellow colour moderately rough and loose and of medium thickness; the inner skin (endocarp) very thin and enclosing juicy sweet pulp of piquant flavour and medium tint of colour. This is a fine orange, but it does not bring a high price, on account of its indifferent appearance.

Láll Ladoo of the Deccan.

I have identified this orange with the Mandarine orange of books. The tree resembles the "*Ladoo*" in habit, leaves and flowers, and shape of fruit, but the skin of the fruit is a deep orange colour, smooth, loose, enclosing 11 liths, having a stronger inner skin than the "*Ladoo*," and 20 seeds—a very handsome, attractive fruit.

Cowla, a small-sized, indifferent orange, which becomes yellow on the tree before it is sweet.

Introduced foreign oranges.

The Sylhet orange, which is common in the Calcutta market, is grown in the country whose name it bears. It averages 5 ounces, has a tight thin skin and good flavour. The Malta and St. Michael's oranges have been introduced, but are not making progress wherever it is possible to grow the "Cintra."

Locations.

(3.) The finest oranges in India and, in the opinion of some, in the world, are grown near Nágpur, which lies in north latitude 21° 9′, and east longitude 79° 11′, about 350 miles from the sea, and at an altitude of 1,025 feet above mean sea level.

The orchards are fully exposed to the sun and on level ground, having a dark-coloured, stiff, loamy soil not less than 3 feet in depth, and overlying a sub-soil of open nodular limestone. The soil is formed of disintegrated basalt.

Climatic influences.

(4.) The climate of Nágpur is shown in the following table, which is compiled from the Government Meteorological Reports:—

Climate details.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly average.
Rainfall	0·61	0·42	0·63	0·45	0·83	8·99	12·94	8·82	7·92	2·15	0·41	0·34	44·51
Mean temperature	68·6	73·8	81·9	88·8	93·1	85·7	79·1	79·3	79·1	77·2	70·7	67·1	78·7
Maximum temperature	89	97	105	107	116	108	94	94	92	93	88	83	116
Minimum temperature	48	50	59	67	72	71	71	72	70	59	50	48	61·4

NOTE.—The climate details are average for five years.

It may be described as comparatively hot and moist from June to September inclusive, cool and dry from October to February, hot and dry from March to May. It must be noted that the temperature is taken under standard meteorological arrangements, which require the thermometer to be shaded from direct sunshine and from radiation at night; mean insolation or excess of temperature obtained by exposing the thermometer to the sun as compared with the shade temperature being 59·8° and the nocturnal radiation or decrease from the shade temperature when the thermometer is exposed to the sky varies from 12·8° in January to 2·7″ in July.

Season of flowering and fruiting.

There are two distinct seasons in which the trees will flower and ripen fruit; and to obtain high class fruit, the cultivator must elect which season he will work, as the trees will not bear properly at both seasons. The finest fruit is obtained from flowers that open in June—July and is on the market from February to May; the second flowering is in February—March; this ripens fruit from December to February.

Irrigation.

(5.) The trees are kept dry during May or December according to the season at which fruit is wanted; at other seasons, irrigation is carried on sufficient to provide., with the rainfall, at least 4 inches of water over the entire surface per month. The irrigation water is drawn from wells, about 30 feet in depth, by means of a leathern bucket containing about 25 gallons, which is drawn up by bullocks that go down an incline, pulling a rope which passes over a simple pulley. The cost of drawing water 32 feet is about 1 anna (at par nearly 3 cents) per 1,000 gallons.

The water is turned into small surface channels made by drawing up a pair of parallel ridges 18 inches apart and 9 inches high, and given a slope of 1 per 1,000. One channel serves two lines of trees, and from it the water is passed into sunk beds round the stem of the tree, extending as far as the sweep of the branches. About 1 to 2 inches in depth is given once in 10 days. The soil is kept moist from the flowering till the fruit is all gathered.

Cultivation.

Fertilizers.

(6.) and (7.) Soil is kept clean and open on the surface by ploughing 4 inches deep 3 times yearly. For the crop that ripens during February, March—April, water is withheld, the soil is opened up during April—May, and the roots exposed during 15 days, so that the trees get a check sufficient to cause the greater part of the leaves to fall. Then 100 lbs. weight per tree of old, moist cowdung of a reddish-brown colour is mixed with the soil, and the roots covered up and watered heavily if rain does not fall soon. This causes the trees to burst into bloom and fresh growth; thereafter the soil is kept moist till the fruit is gathered.

The same operation carried out in December brings ripe fruit during December, January and February.

Pruning.

(8.) Clearing away suckers from below the graft and cutting out weakly or decayed branches only. Excessive pruning must be avoided, as it tends to cause the trees to "run to wood," and prevents flowering.

Picking.

(9.) Fruit continues to attain full development during a month on each "break" of trees that has been started into growth together, and it is picked over at intervals of a few days.

A faint trace of yellow in the skin of the fruit indicates maturity. When fresh from the tree this fruit has a delightful rich piquancy of flavour that is to a great extent lost by being packed up for a few weeks, but the fruit remains in good condition 2 months if not closely packed.

No special curing is given, unless the fruit has been gathered unripe; in that case close packing with soft hay in a box is sufficient. Such fruit is always inferior.

In packing, 30 to 40 lbs. weight of oranges are placed in a very slim basket without any packing, and the lid tied down. None of the fruit is shipped as merchandise.

(10.) The trees are planted about 12 feet apart each way.

(11.) Seeds of *Citrus medica*, a large coarse citron of vigorous habit, are sown, and when the stocks are two or three years old are budded. The form of budding used is peculiar, and, I think, advantageous in unskilled hands. No transverse cut is made in the bark; having made the vertical cut, the operator bends the stems gently towards the side having the cut. This causes the cut to gape open, and the bud having been inserted, the stock is released, and springs up, closing in the shield of the bud. A bandage consisting of a strip of banana stem is then applied. I think the want of the cross cut saves the gumming that ensues if the cut is made too deep. Occasionally the sweet lime, *Citrus limetta*, is used as a stock, and it is believed by some to ensure more sweetness in the fruit. I have not proved this, and do not think it can affect the degree of sweetness.

Seedling or budded.

(12.) The best varieties are invariably budded. Seedlings take so long to bear fruit as to be useless in practical fruit-growing.

Size of orchards.

(13.) The orchards generally measure from 5 to 10 acres.

Age of fruiting.

(14.) The trees begin to bear at 3 years from the bud, carry the heaviest crops between the 6th and 10th year, and after the 15th year rapidly decay.

(15.) An important insect enemy is the caterpillar of *Papilio erithronius*, which eats up the foliage during June—July. Hand-picking is the chief remedy employed. An undetermined wood-boring insect attacks the trees as soon as decay sets in, and is commonly supposed to be a cause of decay. I think it is rather a sign of decay. Hot tar poured into its holes kills the insect, but does not arrest decay when far advanced. If there is any sound wood left, it is advisable to cut back severely, but trees so treated do not fruit for 2 or 3 years after the operation.

It is doubtful whether any insects are beneficial, but the entomology of Indian fruit culture is but fragmentary as yet.

(16.) Lemons are not exported. The large citron can be produced in quantity very cheaply, but, except by dyers for the acid, it is little used and brings a very low price.

(17.) The latest edition of my own book is the fullest account available,* but that is superseded by this report, as far as oranges and lemons are concerned.

B.—FIGS.

(1.)—(3.) Figs are not dried in India to any considerable extent, as the local consumption absorbs the supply.

Varieties of figs are not named in India, except with the name of the village they come from, which is not distinctive. The variety widely cultivated in the Deccan is inverted conical, green at the stalk, and gradually deepening to brown at the broad end; it has alternating stripes of green and brown, and good examples weigh $\frac{1}{7}$th lb.

(4.) The neighbourhood of the village of Khed Shivàpur, 14 miles south of Poona, which city stands in north latitude 18° 28′, east longitude 74° 10′; altitude of Khed Shivápur about 2,200 feet. Exposure to sun full.

Land of the orchards is nearly level, but the orchards are on the slope of a range of hills of 3,500 feet altitude. The altitude of the plantations is 2,200.

Soil and sub-soil.—Poor calcareous loam. Sub-soil, marl, a mixture of lime and clay on disintegrated trap.

(5.) Temperature averages about 75°, minimum 48°, maximum 100°.

The village is shut in on the north, east, and west by hills, which keep out hot winds.

Rainfall about 50 inches, falling chiefly from June to October. The falling of rain sets the trees growing and determines the ripening of fruit.

(6.) Irrigation from wells, 2 inches per month from end of October till the fruit is ripe. Cultivators do not usually make special efforts to get sweet fruit, but the small quantity of water given has that effect.

(7.) Cultivation.—Ploughing 4 inches or hoeing at end of rainy season.

(8.) Fertilizers.—Village sweepings, 50 lbs., well decayed, per tree applied after the crop is gathered.

(9.) Pruning.—After the tree has been caused to send up 5 or 7 branches from near the base by shortening the shoots sent out by the cutting, little, if any, prunning is given, broken branches are cut out, and such as have gone higher than a man can reach with the hand have the points taken off, and are cut out to the base after all the fruit has been gathered, but the less pruning that is necessary the better.

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* Since this was written, Dr. Bonavia's "Cultivated Oranges and Lemons, &c., of India and Ceylon" has been published.

A few are grown as standards, the branches proceeding from the central stem at a height of six feet and spreading out horizontally.

(10.) Picking.—The picking is done when the fruit is full grown, and shows a slight yellowing of the stalk. Early in the morning is preferred, because if protected from the sun, fruit so picked retains a delicious coolness. For local use each fig is wrapped up in a leaf when it has attained this stage, to protect it from birds, and is left on the tree a week longer. This improves the quality greatly, but carriage to a distance is impracticable in such a case. No boxing or curing is done in India.

(11.) The trees are planted 10—12 feet apart.

(12.) By cuttings of 1 year old wood planted in a shady bed in February.

(13.) Orchards are about 2—3 acres in extent only, because the situation on a hill slope does not admit of large level spaces fit for irrigation.

(14.) Trees attain 15 years; are fruitful about 12.

(15.) Red spider is a serious enemy. No futile attempts are made against it by the cultivators; they think sacrifices to idols effectual.

(16.) I have never sent cuttings of figs so far as to America, but I think that if cut in February, packed in moist sand in a tin-box, and sent by post, a few would survive the journey.

(17.) Government of India does not issue such matter regarding fruit. The latest edition of my book, "Gardening in India", gives the fullest account available, but it is not as full regarding figs as this report.

G. M. WOODROW.

Poona, 1890.

VI.—DISTRIBUTION OF INDIAN CROCODILES.

In the latest volume of the *Fauna of British India*, that on the Reptilia and Batrachia, Mr. Boulenger mentions that *Crocodilus porosus* has not been recorded from the West Coast. I can now say that it does undoubtedly occur in North Travancore. I was first led to take up the question of the distribution of the two species by my friend "Smoothbore" of Madras, and on examining the skulls in the Trevandrum Museum, I found one that appeared to me to be a specimen of *Crocodilus porosus*; it had been presented on the 3rd November, 1857 by the then Resident, General Cullen, who sent the following note with it:—

"The animal was killed several years ago in the backwater between Alleppy and Cochin, at a place called Tunneermookum. It had killed several natives, and on the last occasion seized a woman, far advanced in pregnancy, as she was washing; she died of the injuries she received, and the husband and others, vowing vengeance against the brute, at last caught and killed it. They brought it with another one and left it for me at Cochin. It was about 10 feet long. I have records, however, of crocodiles up the river at Cochin near Verapoly of 18 to 22 feet in length. I will look for the reports and send them to you."

Not satisfied with my own identification, I took the skull with me to Madras and showed it to Dr. Thurston, the Superintendent of the Madras Museum, who agreed with me that it was undoubtedly a skull of *Crocodilus porosus.* My only doubt then was whether the specimen might not have been mixed up with others in General Cullen's possession, and have been sent to the Museum with notes that applied to another skull. To clear up this, the only way was to get another specimen from the same locality. The natives here are agreed that there are two sorts of crocodile, one they call "Chingany," the other "Muthala," and after trying in vain to get any satisfactory description of the difference between them, I offered a reward for specimens of the "Muthala."

Specimen after specimen of *palustris* was sent in to me, and some were identified by the natives as undoubted "Muthalas," and still they failed to show any difference or to explain why they gave different names. At last, from the same locality as General Cullen's specimen, came an undoubted *Crocodilus porosus*, about 7 ft. 6 inches long; it is now in the Museum, and the curious thing is that the natives can see no difference between it and a specimen of "*palustris*," and do not admit that it is a "Muthala."

H. S. FERGUSON.

Trevandrum, March, 1891.

VII.—VICTORIA CROWN PIGEONS BREEDING IN CONFINEMENT.

Victoria Crowned Pigeons (Coura Victoriæ).—In 1888, three specimens, a male and two females, were received in the Trevandrum Zoological Gardens from Calcutta. This year the females began to fight and had to be parted. The pair left began to build a nest, and being supplied with sticks and fibre made a flat arrangement on a platform there was in the cage, about 8 ft. from the ground. One egg was laid, and in about three weeks a young one was hatched, and is now just fledged and goes about with its parents. I should think it is unusual for these birds to breed in captivity, and so record it.

Continuing the subject of breeding, I may mention that the Mouse Deer (*Memina indica*) have bred in the gardens, and the period of gestation is, as near as possible, five months.

H. S. FERGUSON.

Trevandrum, March 1891.

VIII.—INDIAN OTTERS.

In the first volume of the "*Fauna of British India*," Mr. Blandford says that, "owing to the circumstance that the next species, *L. Ellioti*, has only lately been clearly distinguished, the relative distribution of the two (*L. vulgaris* and *L. Ellioti*) cannot be precisely ascertained." Both occur in Travancore, but *L. vulgaris* is by far the commoner and is fairly abundant. There was at one time a specimen of *L. vulgaris* and two of *L. Ellioti* in the gardens at the same time, both species having been captured close to Trevandrum; the difference in the shape of the head is very obvious when the animals are seen together, that of *L. vulgaris* appearing almost spatulate in comparison with the other.

H. S. FERGUSON.

Trevandrum, March, 1891.

No. IX.—OUR HYMENOPTERA.

In my paper on "Our Hymenoptera" (Vol. IV., page 26,) I recorded:—"Very little seems to be known of the life history of *Mutilla*. The general opinion seems to be that the ♀ makes burrows in the sandy soil, provisioning her nest with flies. I feel certain, and I hope shortly to have convincing proof, that some at least of our *Mutillidæ* are parasitic, not by means of lurking house-trespass, like the *Chrysididæ*, but by burglary on the mud nests of other Hymenoptera." I have just received a letter from Major Yerbury, in which he writes: "I took some mud nests off the walls of the bungalow at this tank (Periyakulam, Ceylon), and from one of them bred two *Mutillæ* ♀." I think this interesting fact is worth recording.

ROBERT C. WROUGHTON.

Poona, April, 1891.

PROCEEDINGS.

PROCEEDINGS OF THE MEETING ON 14TH JANUARY, 1891.

The usual Monthly Meeting of the Members of this Society took place on Wednesday last, the 14th January, and was largely attended. Mr. G. W. Vidal, C.S., presided.

The following gentlemen were elected members of the Society:—The Hon. Mr. N. N. Wadia, C.I.E., Rev. Charles Ferrell (Sehore), Professor R. G. Oxenham (Bombay), Mr. F. T. Bird (Castle Rock), Mr. C. V. Osman (Bombay), Mr. R. A. D. Sewell (Nellore), Mr. A. F. Beaufort (Bombay), Mr. Varman B. Davatia (Nandod), Mr. E. C. Monod, and Mr. W. G. Wilson (Bombay).

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions to the Society's Museum:—

CONTRIBUTIONS DURING DECEMBER.

Contributions.	Description.	Contributor.
2 Young Hyænas (alive) ...	Hyæna striata	Mr. Babaji Gopal.
1 Krait	Bungarus arcuatus	Mrs. Solly-Flood.
1 Nest of Common Honey-sucker	Cinnyris zeylonica............	Dr. Kirtikar
A number of Teredos and other marine animals.	From the Prince's Dock ...	Mr. Geo. Ormiston.
2 Cobras	Naga tripudians................	Mr. C. E. Kane.
1 Ruddy Shelldrake	Casar rutila	Mr. E. L. Barton.
2 Pintail Snipe	Gallinago sthenura	Do.
2 Jack Snipe	Gallinago gallinula	Do.
1 Painted Snipe...............	Rhynchæa capensis	Do.

Contributions.	Description.	Contributor.
1 Gazelle's Skull	From Africa	Capt. R. H. Light.
1 Hyæna's Skull	Hyæna maculata	Do.
A number of Snakes	From Berbera	Do.
2 Snakes	Doboia elegans	Mr. G. de Soane.
1 Tortoise (alive)		Mr. F. Blyth.
1 Leopard Cat (alive)	Felis bengalensis	Dr. Dimmock.
1 pair Sambur Horns	From the Berars	Mr. A. Wilson.
A Dhaman (alive)	Ptyas mucosus	Mr. G. de Soane.
1 Flamingo	Phœnicopterus antiquorum	Mr. W. Gaye.
1 Bittern	Botaurus stellaris	Mr. Alfred Mull.
1 Muntjac	Cervulus aureus	Mr. C. F. Van-Ingen.
1 Civet Cat	Viverricula malaccensis	Mr. F. M. Stephen.
2 Snakes	Daboia elegans, and Zamenis fasciolatus	Mr. C. E. Kane.

MINOR CONTRIBUTIONS FROM

Mrs. Hojel, Mr. F. L Goldsmid, Dr. Bourne, and Mr. C. R. Brendon.

CONTRIBUTIONS TO THE LIBRARY.

Fauna of British India :—

Fishes, Vols. I., II. (interleaved). Mr. W. F. Sinclair, C.S.

Birds, Vol. II. (do.). Do.

Reptiles. (do.). Do.

Geological Survey Report, Part 4. In exchange.

Water Birds of India, Vol. II. From the author.

Two Photographs of Birds at Jeypore Zoological Gardens. Mr. G. W. Vidal, C.S.

Notes on Indian Rats and Mice (W. L. Sclater). The author.

Journal, Asiatic Society of Bengal, Vol. LIX., Vol. 3. In exchange.

ACCOUNTS FOR 1890.

A statement of the accounts of the Society for the year ending 31st December, 1890, prepared by Mr. E. M. Slater, the Honorary Treasurer, was laid upon the table. It was resolved that the accounts be passed, subject to the audit of Mr. J. Wallace, C.E.

THE PROPOSED INTRODUCTION OF GAME INTO THE NEIGHBOURHOOD OF BOMBAY.

Mr. H. Littledale, of Baroda, in bringing forward his proposal, said :—

"I beg to suggest that an attempt should be made to introduce the Chukor into this part of India. Such an effort would certainly succeed on the Aravellis and Vindhyas, along the big rivers. Again, the Painted Partridge is our only Southern-Bombay bird ; the Black Partridge, a far finer bird, ought to take advantage of the R. M. Railway and settle in our grass *birs.* He flourishes on the hot grassy plains of Rajpootana, amid the tamarisks of the Indus, and along the banks of the Jhelum in Cashmere ; any climate seems to suit him, wet or dry.

The Chukor stretches across Asia, Africa, and Europe, from the Chenab to the Rhone; I have found its nest, at 11,000 feet, in Baltistan, and it ranges through the low hot levels of Mekran and Arabia. It is a very *gamey* bird, and, if a fair chance were given it, it would certainly thrive on our ghâts everywhere.

The Bengal Florican might also be tried. Game is said to be getting scarcer. Shikaries should try and introduce new blood.

Again, the Markhor might flourish on the Neilgherries; it lives at 7 to 9 thousand feet in the rainy Pir Pinjal, and the Neilgherry climate would suit it perfectly. There are several African animals, antelopes and so forth, that would thrive in India, and might be easily introduced.

Let our Sectional Committees take this suggestion up, if they think it worth acting on. Money would certainly be forthcoming for a well-considered scheme of introducing to the Bombay side animals that would probably thrive there and give good sport to future generations of sportsmen. I look to this, rather than to vexatious game laws, to provide such shikar in the future as has been enjoyed in the past"

Mr. G W. Vidal said that he had received a letter from Mr. E. C. Ozanne, the Director of Agriculture, in which he offered to allow the Society to make use of the Government farms at Budgaum, Poona, and Aligaum for experiments in connection with the acclimatization of game birds. Mr. Vidal also pointed out that land suitable for Black Partridges existed in the neighbourhood of Poona, where experiments might be made, such as the large areas round the Powder Works and the Yerrowda Gaol. No doubt Mr. Meakin would also allow similar experiments to be made on the land round his brewery.

Mr. N. S. Symons addressed the meeting as follows:—

"With regard to the proposals before us, it would be well to know some facts before we vote money. I will, with your permission, give some facts, many of which will be in favour of Mr. Littledale's proposals, but some against a portion of them. I confine my remarks to the Bombay Presidency and Sind. I will first take the Black Partridge or Common Francolin. Many specimens of this bird have been found in Cutch. It was in past years very common in Sind. It is now comparatively scarce there, so scarce, indeed, that we need not expect to get any stock from Sind. The destroyers of birds for their feathers have cleared that province of all surplus stock. But any number of birds, up to the quantity we are likely to want, can be obtained from Bengal. The Black Partridge, like all Indian Partridges, is very fond of tamarisk jungle, of which there is plenty in this Presidency, and also of high-grass jungle—particularly if there are wheat fields near. It is not partial to rice food—and so it may be difficult to acclimatize in the Konkan. It is not a runner like the Red-legged French Partridge, or the Grey Partridge, or the Chukor. It feeds also largely on insects and larvæ, grain, and seeds of dry crops, and, like Grouse, also on tender shoots of herbs. They do not, as a rule, hatch more than two or three young ones out of a nest. The average weight of males and females is about 16 oz.

I now come to the Painted Partridge or Southern Francolin. This is the only Partridge, I believe, to be found in the Konkan, or, at any rate, within fifty or sixty miles of Bombay. The male bird resembles the female Black Partridge very closely in plumage, but, curiously, Nature has defined the limits of each variety, and rarely have both specimens been found in the same locality. This species is very common in the Konkan. I have heard of as many as ten brace having been killed by one gun within eighteen miles of Bombay this season in a short day's sport, and there are vast tracts in the Konkan where the bird is indigenous. But, owing to the want of protective game laws, this partridge has already become scarce compared to what it was ten or twenty years ago. As an instance of this, I may state I walked over several miles of partridge country in the Konkan on the 11th of this month, with a line of beaters, and only saw six Painted Partridges all day. I remember eleven years ago that two Bombay sportsmen shot twenty odd brace in a morning's sport.

The Painted Partridge is somewhat of a runner, but is not to be compared in that respect with his brothers, the Grey Partridge or the Chukor. He is a good bird to eat when properly cooked. He is a good breeder, generally hatching six to eight. I look upon him as the very best bird to be saved from destruction by Bombay naturalists—whether by game laws or otherwise. The average weight is about 10 oz.

I next mention the Grey Partridge. I dismiss him as quite unworthy of our attention. He does not exist in the Konkan. He is a dirty feeder, and is always to be found near the filthiest spots round villages in Guzerat, &c.

I now come to the Chukor. This species is one of the red-legged sorts, therefore a runner, and is not, from a sportsman's point of view, as well worth attention as the Black Partridge or the Painted Partridge. It is chiefly found in mountainous districts, and I very much doubt if it would thrive on low-lying lands. Very few years ago some sixty brace of Chukor were sent through me (by Captain Allen) from the low hills of the Himalayas to Ootacamund in the Neilgherry Hills. Hardly a single bird was lost in transit, but I believe I am correct in saying they were a failure. However, I must qualify that by saying I have not had any information on the point for a whole year. Only I do know that I shot for nearly a month over the grounds where they were turned down near Ootacamund, in the autumn of 1889, about two or three years after they were forwarded, and I never saw one, or heard of one. And there were usually quite a dozen Spaniels present at those hoots. After this experience I am not an advocate for introducing Chukor into this Presidency. But I take the opportunity of suggesting that we make an experiment with pheasants. I thoroughly believe that if pheasants were turned down in the grass lands and teak jungles near the Western Indian Ghâts, and protected, that a splendid stock might be reared. Every kind of suitable food is present in those jungles for pheasants, and there is plenty of water. I should add about the Bengal Florican that it would be a most interesting experiment, as the bird is not known west of the Ganges. That it is possible it would thrive on the same lands and food as its smaller half-brother, the Lesser Florican or Likh, which is not uncommon in the Deccan and at the Null in Guzerat. I should doubt, however, our being able to obtain the Bengal Florican in sufficient quantities. I should also suggest the introduction of the African Guinea Fowl. Whatever we do now, we shall do more for the next generation probably than for ourselves. The proposal about Markhor can only be taken as a suggestion to offer to the Neilgherry Game Association.

Something might also be done for the preservation of other indigenous game in this district, namely, Peafowl, Bekri, or four-horned Antelopes and Cheetal

Regarding those last I have no hesitation in stating, from personal experience, that the stock has decreased to one-tenth from what it was twelve or twenty years since. My remarks, it will be seen, are confined chiefly to the Konkan, or, say, thelow-lying grounds below the ghâts within, say, sixty miles of Bombay. But my opinion and experience is that both in Guzerat (North and South) and in the Deccan there has been a huge decrease of indigenous antelopes and indigenous game birds in the past ten to fifteen years. Apart from trappers, to whom this decrease is largely due, I think there has been a great increase of birds of prey—Eagles, Harriers, and Hawks. If any Game Acts were introduced, there would be naturally keepers or watchers who would trap vermin. At present I think such vermin are so plentiful that even the "survival of the fittest" is hardly possible amongst the indigenous game birds. I do not look upon the Owl as a poacher, but he is increasing in numbers. On December 26, 1889, my brother and I flushed 42 owls from a small patch of high grass in the Konkan. Although I have given you these facts, some of which, as you will see, are not wholly in accordance with the proposal before the meeting, I wish it to be understood that I am very much in favour of our Society taking up the subject on the general line suggested by Mr. Littledale. We might form a strong committee of members of this Society, drafted from our local naturalists and sportsmen, and from up-country members, the opinion and advice of whom would be of infinite help in carrying on the present proposals. This is especially to be remembered when we look over the list of members, which includes many names of the highest Princes and Rajas of this Presidency, and members of the Civil Service and of Forests, who have the means, and who have one and all always been most generous and far-sighted in helping onwards this most useful Society. Mr. President, ladies and gentlemen, I hope you will vote for the appointment of a strong committee, and allow that committee to allot a substantial sum of money (of course, within the limits of the Society's means without embarrassment) to further this proposal. From a naturalist's point of view, apart altogether from that of sport, it is well deserving of support from our Society; and I have no doubt that such a committee as I suggest will cover much more ground than I have ventured to advocate.

Mr. J. D. Inverarity and Mr. R. Gilbert having spoken in favour of experiments being made by the Society, the following resolutions were passed :—

Resolution No. I.—That the following members of the Bombay Natural History Society be asked to form a Special Committee (with power to add to their number) for the purpose of carrying out experiments with a view of ascertaining what game birds and animals can be introduced into this Presidency with a fair prospect of success :—Messrs. E. H. Aitkin, Ameerudin Tyebjee, J. C. Anderson, Captain W. R. Anderson, Captain J. S. Ashby, Mr. E. C. S. Baker, Lieut. H. E. Barnes, Mr. T. R. D. Bell, Dr. Banks, Mr. J. A. Betham, Mr. E. L. Barton, Mr. H. Bicknell, Major W. S. Bissett, R E., H. H. the Thakore Saheb of Bhownugger, Dr. Boyd, Mr. A. W. Crawley-Boevey, C.S., Capt. G. Hyde Cates, Dr. Childe, Mr. C. P. Cooper, Mr. L. Crawford, H. H. the Rao Saheb of Cutch, Messrs. S. B. Doig, C.E., C. F. Elliott, Reg. Gilbert, F. Gleadow, C. Gray, Col. Gunthorpe, Capt. A. Gwyn, Mr. F. Goldsmid, Mr. E. Giles, Dr. Hatch, Mr. W. J. Holland, Col. W. C. Hore, H. H. the Maharajah Holkar of Indore, Mr. H. E. M. James, C.S., Mr. C. E. Kane, Capt. R. H. Light, Mr. H. Littledale, Col.

Kenneth Mackenzie, Messrs. W. S. McClelland, W. S. Millard, G. P. Millett, Col. Merriman, R.E., Messrs. A. Morrison, Wm. Murray, R. H. Macaulay, Col. H. L. Nutt, Capt. A. Newnham, Messrs. E. W. Oates, H. T. Ommaney, C.S., E. C. Ozanne, C.S., Col. W. Peyton, Mr. Y. E. Penton, Capt. W. St. John Richardson, Messrs. A. M. Ritchie, L. P. Russell, W. Shipp, C.E., A. F. Simpson, Proctor Sims, W. F. Sinclair, C.S., N. S. Symons, W. Thacker, E. Thom, R. H. E. Thompson, Chas. Taylor, G. W. Vidal, C.S., H. Wenden, C.E., Col. Westmacott, Mr. W. H. White, C.E., Mr. A. D. Younghusband, C.S., Major J. H. Yule, and the Honorary Secretary of the Society.

Resolution No. II.—That the sum of Rs. 500 be placed at the disposal of the Special Committee to defray the cost of their experiments.

The Meeting then ended with a vote of thanks to Mr. H. Littledale for coming down from Baroda in order to bring forward the above proposal.

PROCEEDINGS OF THE MEETING ON 18TH FEBRUARY, 1891.

The usual Monthly Meeting of the Members of this Society took place on Wednesday last, the 18th February, and was largely attended. Dr. D. MacDonald presided.

The following gentlemen were elected members of the Society:—Major W. W. Loch (Jodhpore), Mr. Charles E. Frost, C.S. (Ahmedabad), Mr. F. S. P. Lely, C.S. (Surat), Mr. F. Welter, and Mr. E. B. Raikes.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions to the Society's collections:—

CONTRIBUTIONS DURING THE MONTH OF JANUARY.

Contributions.	Descriptions.	Contributors.
1 Wild Ass's Skull	From the Somali Coast	Mr. J. D. Inverarity.
2 Persian Gazelles (alive)	Gazella subguttrosa	Capt. Houston.
2 Guinea Fowls	From the Somali Coast	Capt. Plommer.
1 Persian Gazelle (alive)	Gazella subgutturosa	Do.
1 Python (alive)	Python molurus	Mr. W. C. Clements.
1 Skin of Klip-springer	Oreotragus saltatrix	Mr. J. D. Inverarity.
2 Snakes (alive)	Sillybura sp.	Mr. C. Smith.
1 Muntjaj (alive)	Cervulus muntjak	Mrs. E. Wilkin.
1 Malabar Squirrel (alive)	Sciurus indicus	Mr. F. A. Hill.
1 Persian Gazelle (alive)	Gazella subgutturosa	Capt. Gimlette.
1 Snake	Lycodon aulicus	Mr. N. S. Symons.
1 Russell's Viper	Daboia elegans	Mr. G. de Saone.
1 Black Buck's Head	Deformed	Major Fenton.
1 Screech Owl (alive)	Strix javanico	Mr. M. Melling.

Minor contributions received from:—Mr. W. F. Sinclair, Col. C. D. La Touche, and Mr. E. L. Barton.

CONTRIBUTIONS TO THE LIBRARY.

The Canadian Entomologist, Vols. XXII., XXIII., in exchange; the Entomological Society of Ontario, Report for 1889, in exchange; the Victorian Naturalist, Vol. VIII., No. 9, in exchange; Annali del Museo de Stovia Naturale di Genova, Vols. VII. to IX., in exchange; and Notes on Indian Horned Game, by W. L. Sclater, from the author.

BOMBAY GRASSES.

Dr. J. C. Lisboa read the third part of his paper on Bombay grasses, illustrating his remarks with dried specimens from his herbarium, together with numerous fresh grasses collected by him for the occasion. Dr. Lisboa stated that he had named one of the grasses, which was new, *Arundinella campbelliana*, in honour of Mr. J. M. Campbell, C.S., C.I.E., the Compiler of the *Bombay Gazetteer*, who had rendered the greatest assistance in the collection of grasses through Forest officers in Gujerat, the Deccan, the Konkan, and in other districts of the Bombay Presidency.

MARKHOR SHOOTING IN EAST AFGHANISTAN.

The Honorary Secretary read a paper received from Mr. John E. Penton, District Superintendent of Police, Jacobabad, describing his experiences while shooting markhor, the straight-horned variety, in East Afghanistan, whose habitat Kinloch gives as *Yusufzaie*, the *Khaibar, and other parts of Northern Afghanistan.*

A WOUNDED BEAR CHARGING UP A TREE.

Mr. J. D. Inverarity then gave a graphic account of an adventure which happened to him in the Central Provinces on 17th May, 1890, when a bear, which he had wounded in two places, charged him while he was seated in a tree 13 feet from the ground. The claw marks on the tree showed that the bear had reached to within a few inches of the sportsman's feet before he could reload and fire. A lithographed plate, from a photograph taken on the spot, illustrating this uncommon incident, was exhibited.

THE BENGAL WATER-COCK.

Mr. H. Littledale, of Baroda, recorded, for the first time in Gujerat, the Bengal Water-cock (*Gallicrex cristatus*), a specimen having been shot near Baroda in his presence on 25th September, 1890, by Lieutenant Percy Bell.

RED ANTS' NEST.

Mr. E. H. Aitken sent an interesting account, which was read at the Meeting, on the manner in which the red ants (*Ecopilla smaragdina*) construct their nests in trees.

PITHECOLOBIUM UNGUIS.

Mr. G. Carstensen, the Superintendent of the Municipal Gardens:—The flowers and fruit from this tree (exhibited on the table) are of so highly ornamental a character that the tree in question seems to deserve general cultivation in Bombay gardens. The plant now in flower and fruit in the Victoria Gardens was raised from seed received from the well-known seedsmen, Andronze & Co., of Paris, in 1888. Of about ten seeds only one germinated, which remained in the seed pan for about a year, when it was planted out in the ground in 1889 among other trees of the same order (*Leguminosæ*). It has now attained a height of about 8 feet, and seems to grow into a much branched tree. Of the other representatives of the same form genus *Pithecolobium dulce* (*Inga dulcis*) is a well-known tree in all Indian gardens. The present kind is distinguished by broader leaflets, considerably larger and almost showy flower heads, narrower and longer, less fleshy, bright red, curiously twisted pod, which when bursting show the black seeds, imbedded in a scarlet seed-coat (*arillus*). Both the feathery greenish-yellow flower heads and the coral-like graceful pods give a peculiar attractive appearance to the tree. The typical kind is an extremely common tree in the West Indies, and owes its name to its paw-like thorns. The variety is, however, unarmed and is stated to have been found in Guadeloupe only.

The Meeting then ended with a vote of thanks to the gentlemen who had contributed papers.

PROCEEDINGS OF THE MEETING ON 31st MARCH, 1891.

The usual Monthly Meeting of the Members of this Society took place on Tuesday, the 31st March, 1891, Dr. MacDonald presiding.

The following gentlemen were elected members of the Society :—Colonel A. M. Rawlins, R.A. (Poona), Lieutenant L. H. Parry, R.A. (Hingoli), Lieutenant H. L. Goodenough (Erinpura), Dr. D. St. J. Grant (Dharmsala), Mr. A. Mair (Bombay), Mr. Pestonjee Jewunjee, C.S. (Nakrakal), and Mr. J. Fairclough (Bombay).

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following

ERRATA.

At p. 124. *For* Pithecolobium unguis, *read* Pithecolobium unguis. Cate-Var. Guadeloupense

At p. 124. *For* Andronze & Co. *read* Vilmorin, Andrieux & Cie.

1 pair of Horns	Ovis ammon	Capt. H. V. Benett.
1 Porcupine (alive)	Hystrix leucura	Mr. Chester Macnaghten.
1 Owl (alive)	Strix javanica	Mr. T. Le Messurier.
Fossil Crabs	From Burma	Major F. W. Snell.
1 Sambhur head	Deformed	Mr. F. T. Bird.
1 Porcupine (alive)	Hystrix leucura	Col. Gerard.
1 pair of Sambhur Horns	From Deoli	Major Thornton.
1 Sea Gull (alive)	Larus brunneicephalus.	Dr. T. S. Weir.
1 Leopard Cat	Felis bengalensis	Mr. W. F. Sinclair, C. S.
6 Black Buck Heads 2 Chinkara head	From Kattywar	Major Fenton.
Thumb and Forefinger of a Boy.	Found in the stomach of a panther	Mr. C. A. W. Davies.
1 Sea Turtle	Chelonia viridis	Dr. De Monte.
4 Snakes	Tropidonotus plumbicolor Silybura macrolepis Trimeresurus striatus Lycodon aulicus	Mr. T. R. D. Bell.
1 Ratel (alive).	Mellivora indicus	Mr. Fillis.
A quantity of Snakes, Lizards, &c.	From Kanara	Mr. E. H. Aitken.
1 Krait	Bungarus arcuatus	Col. A. Mayhew.
2 Lizards	Eublepharis hardwickii	Do.
Head of the White-faced Stiff-tailed Duck	Shot at Sialkot	Lieut. C. Kendall Bushe.
2 Long-haired Guinea Pigs (alive).	Cavia cobaya	Mr. J. Collett.
2 Young Panthers (alive).	Felis pardus	Mr. F. R. Desai.
4 Crocodiles' Eggs	Crocodilus palustris	Mr. Jas. Lindsay.
Head and Dorsal Fin of Sword-fish.	Histiopharus brevirostris	Mr. A. H. Unwin.
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Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions to the Society's Museum :—

CONTRIBUTIONS DURING THE MONTH OF FEBRUARY.

Contributions.	Descriptions.	Contributors.
2 Pups of Wild Dog (alive).	Cyon dukhunensis	Mr. A. Elliott, C. S.
2 Dusky-horned Owls (alive)	Bubo coromandus	Mr. H. Bulkley.
Specimens of Deep-sea Soundings	Red Sea	Capt. Scott Smith.
Nest and Eggs of African Weaver Bird	From Berbera	Lieut. C. D. Lester.
1 pair of Horns	Ovis ammon	Capt. H. V. Benett.
1 Porcupine (alive)	Hystrix leucura	Mr. Chester Macnaghten.
1 Owl (alive)	Strix javanica	Mr. T. Le Messurier.
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MINOR CONTRIBUTIONS FROM

Mr. G. De Saone, Mr. H. R. Cooke, C.S., and Mr. H. S. Davies.

CONTRIBUTIONS TO THE LIBRARY.

The Indian Forester, Nos. 10-12, in exchange.

The Flora of British India (Sir J. D. Hooker), from Government.

The North American Fauna, Nos. 3 and 4, in exchange.

On Megascolex cœruleus, with a theory of the course of the blood in Earth-Worms, by Prof. G. A. Bourne, presented by the author.

Bulletin de la Société Zoologique de France, January, 1891, in exchange.

The Locust of North-West India (Acridium peregrinum), by E. C. Cotes, presented by the author.

The Canadian Entomologist, Vol. XXIII., No. 2, in exchange.

The Victorian Naturalist, Vol. VII., No. 10, in exchange.

A Catalogue of the Mantodea, by J. Wood Mason, presented by the author.

THE WHITE-FACED STIFF-TAILED DUCK.

The Honorary Secretary stated that he had received a letter from Lieutenant C. Kendall Bushe, stating that he had killed a White-faced Stiff-tailed Duck (*Erismatura leucocephala*) in the neighbourhood of Sialkot, which, according to Hume and Marshall, has not been recorded in India before.

A MAN-EATING PANTHER.

The Honorary Secretary read a letter received from Mr. C. A. W. Davies, of Basim, Berar, containing a graphic account of a man-eating panther, shot by him on the 13th February last. The panther appears to have attacked an encampment of Banjaris, and carried off a boy who was sleeping close to the rest of the party. The skull, stripped of its flesh and hair, was found the next morning in a nullah close by, and the trunk of the boy's body was eventually discovered lying across the branches of a large moha tree where it had been skilfully hidden, a considerable distance above the ground, by the cunning creature. Mr. C. A. W. Davies eventually succeeded in shooting the panther, and removed from the stomach several fingers of the boy, two of which had been forwarded to the Society in spirits.

Mr. J. D. Inverarity stated that it was by no means an uncommon occurrence for panthers to hide their food in trees, and he had himself met with a case in which the body of a spotted deer had been dragged up a tree, a considerable distance from the ground, by a panther.

It was resolved that Mr. Davies' letter should be published in the Society's Journal.

HARPOONING CROCODILES.

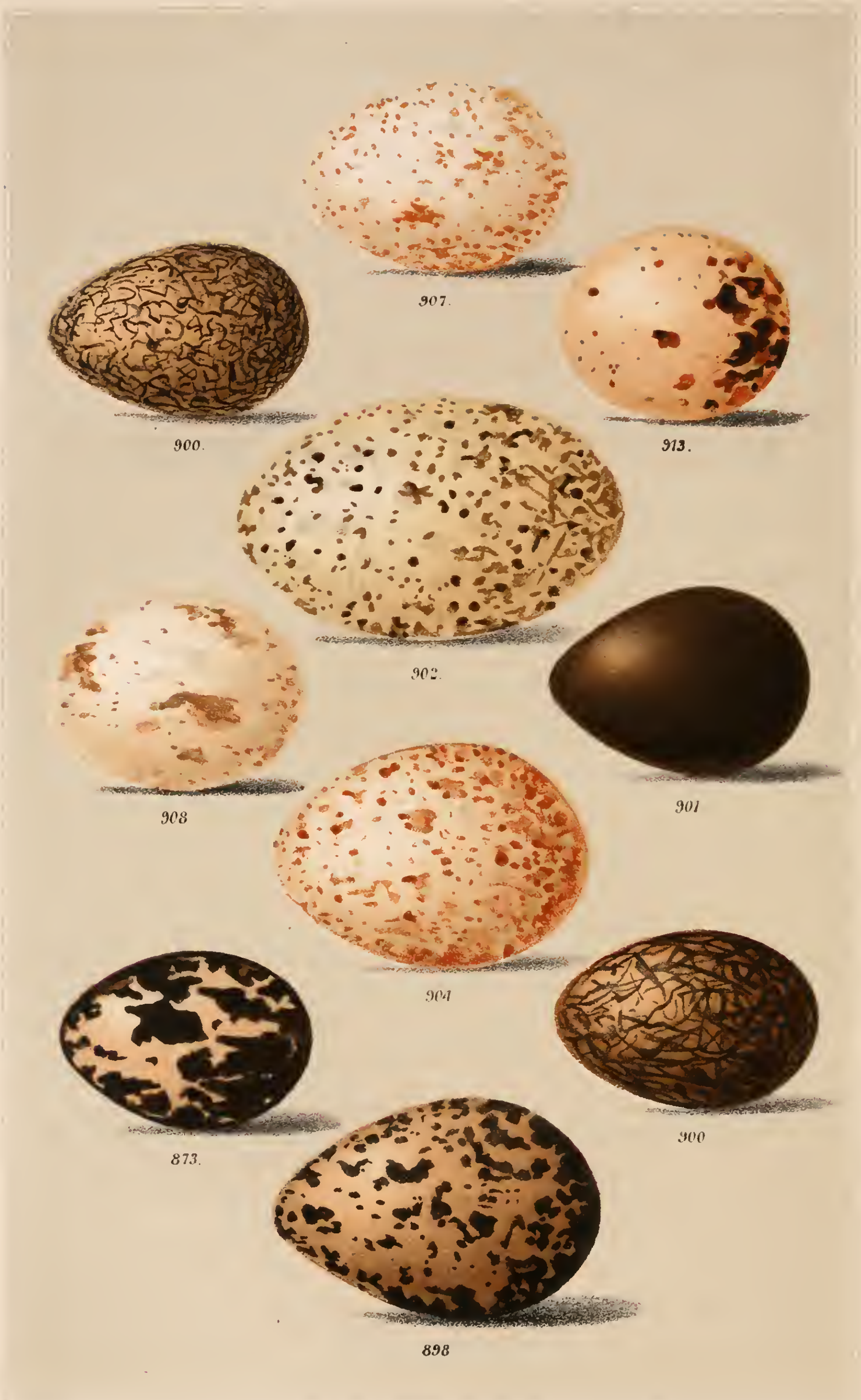
The next paper laid before the Meeting was from Captain Sutton Jones, of Deoli, Rajpootana, containing an account of how he had, with the assistance of Captain Penrose, succeeded in destroying 18 crocodiles (*C. palustris*) in the village tanks, in the neighbourhood of Deoli, by spearing them under water, and dragging them to the shore by means of a rope attached to the spear-head.

BOMBAY FERNERIES.

Mr. G. Carstensen, the Superintendent of the Municipal Gardens of Bombay, then read a very valuable and interesting paper on *Ferneries*, illustrating his remarks with numerous specimens of ferns, palms, foliage plants, and orchids. Mr. Carstensen divided his paper into three parts, dealing with the construction management, and contents of what are usually termed ferneries, but for which a more comprehensive name was required. The paper, which is supplementary to the lecture on Bombay Gardens recently delivered by Mr. Carstensen, was listened to with much interest by those present at the meeting, and will be printed in full in the Society's Journal.

THE ODORIFEROUS GRASSES.

Mrs. J. C. Lisboa then read extracts from a paper which she has written for the Society's Journal, containing a complete account of the odoriferous grasses of India. Mrs. Lisboa also placed before the meeting a large collection of these grasses together with a description of a new species of *Andropogon* hitherto inedited.



H. E. B. del.
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873 RHYNCHÆA BENGALENSIS, Lin. The Painted Snipe. 898 HIMANTOPUS CANDIDUS, Bonn. The Stilt.
900. PARRA INDICA, Lath, Bronze-winged Jacana. 901 HYDROPHASIANUS CHIRURGUS, Scop, Pheasant-tailed Jacana.
902 PORPHYRIO POLIOCEPHALUS, Lath, The Purple Coot. 904. GALLICREX CINEREUS, Gm. The Water Cock.
907. ERYTHRA PHŒNICURA, Penn, White-breasted Water Hen 908. PORZANA AKOOL, Sykes, The Brown Rail.
913. HYPOTÆNIDIA STRIATA, Lin. Blue-breasted Banded Rail.

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NESTING IN WESTERN INDIA.

By Lieut. H. E. Barnes, F.Z.S.

(*With a plate.*)

(*Continued from page 25, Vol. VI.*)

863.—THE SARUS.

Grus antigone, Lin.

Roughly speaking, the Sarus Crane does not occur in the southern half of Western India ; is very rare immediately north of Bombay ; becomes less uncommon in Khandeish ; is very common in Guzerat, Cutch, and Rajpootana ; again becomes uncommon in Lower Sind, and does not occur at all in Upper Sind.

They are permanent residents where found, breeding towards the middle of the rains, making a huge nest of rushes and reeds, in some spot either surrounded by water, or in the centre of a marsh. Sometimes the nest is commenced in the water itself, in which case the egg cavity is about eight or ten inches above the water. The eggs, almost always two in number, are elongated ovals in shape, a good deal pointed at one end, measuring from 3·8 to 4·48 inches in length, and from 2·35 to 2·75 in breadth, but the average of a good many was 3·96 by 2·56.

The shell is hard and strong, and is generally somewhat glossy, frequently exhibiting creases or wrinkles, more especially at the larger end.

The ground-colour varies from pure white to pale sea-green and pinky-cream colour. Occasionally they are quite devoid of markings, but generally they are more or less blotched and clouded with pale yellowish-brown and purplish-pink.

They pair for life. At the breeding season they assume a pure white collar, immediately below the crimson papillose skin of the neck, which also becomes brighter in colour, and in old birds the tertiaries and some of the scapulars become white and more lengthened, hanging over gracefully and exceeding the tail.

The Sarus occasionally breeds in the cold weather, thrice have I found eggs at that season, once at Gangrar, 60 miles from Neemuch, on the 5th February; again at Jeerun, 12 miles from Neemuch, on the 3rd March; and once at Saugor, Central Provinces, on the 18th February. A note on this subject was published in the Society's Journal, Vol. II., p. 149.

Mr. Littledale found eggs on the 4th October in a nest from which he had previously taken eggs on the 21st September, and on the 3rd October he also took eggs. This is late.

Deesa.	*August and September.*	*H. E. Barnes.*
Neemuch.	*Do.*	*Do.*
Baroda.	*September and October.*	*H. Littledale, B.A.*

873.—THE PAINTED SNIPE.

Rhynchœa bengalensis, Lin.

The Painted Snipe occurs more or less commonly in suitable localities throughout Western India, but is somewhat locally distributed. It frequents swamps and marshes, and is common on the borders of tanks and jheels, and along the banks of rivers, where these are fringed with rushes, reeds, and grasses.

They are permanent residents, but necessarily vary their quarters a good deal, as the tanks and jheels dry up or otherwise, but they appear to be much more common in the rains and cold weather than at other times.

They breed at different periods, in different localities, and I am inclined to think that they have two broods, but the majority of the birds lay during the middle of the rains.

The nest is a more or less compact pad of sedge and grass, usually sheltered by a patch of reeds or rushes, but it is occasionally quite exposed, but always, I believe, in a wet place.

The eggs, usually four in number—I have thrice taken five—are moderately broad ovals in shape, pointed at one end. They are hard in texture and moderately glossy. The ground-colour is pale buff or warm *café-au-lait*, thickly and boldly streaked with rich brown, almost black.

They measure 1·4 inches in length by about an inch in breadth.

Deesa.	*September and October.*	*H. E. Barnes.*
Hyderabad, Sind.	*May to July.*	*Do.*
Neemuch.	*May and September.*	*Do.*
Baroda.	*September and October.*	*H. Littledale, B.A.*

893.—THE COMMON SAND PIPER.

Tringoides hypoleucos, Lin.

The Common Sand Piper occurs as a cold weather visitant throughout Western India, frequenting the sea coast, banks of rivers, borders of ponds, tanks, and jheels, in short, wherever there is water. They breed abundantly in Cashmere, laying four eggs.

They do occasionally breed in India, as Mr. Doig records the following note in "Stray Feathers." *

" On the 3rd July my man found a nest of this species containing two eggs, he shot the parent bird, which he saw sitting on the eggs, as it left the nest. This he carbolized and sent to me; the eggs being hard set, he was unable to preserve them. I sent the fragments of the carbolized bird to Mr. Hume, who identified them as belonging to this species. The nest was a few shells and sand scraped together near the water's edge of a salt deposit, and on these the eggs were laid. These eggs my man described as being similar to those of *Ægialitis minutus*, but larger and more strongly marked."

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* *Stray Feathers*, Vol. IX., p. 282.

Captain Cocks' account of the nest and eggs is as follows* :—

"I found the Common Sand Piper breeding plentifully on the banks of all the streams that run into the Cashmere Valley, and took many nests on the Sind river in May and June.

"The nest is placed a few yards from the water in an open situation in stony localities amongst low sage bushes. It is on the ground in a slight depression, generally to the north of a low bush, and consists of a few little pieces of stick or a few fragments of dead leaves. It always contains four eggs, the pointed ends of which are placed together in the centre. The bird gets off the nest very slowly, as if it wished to attract attention to itself."

The eggs are described as being typically ovate-pyriform in shape, fine and close in texture, and slightly glossy. The usual colour is a pale creamy-stone, with a buffy *café-au-lait*, or sometimes even a pinky tinge. The markings are a rich red-brown, occasionally almost black, and consist of speck and spots, intermixed with underlying clouds and spots of reddish, sometimes pale inky-purple.

The markings are usually more dense at the larger end, occasionally forming an almost confluent cap.

In length they vary from 1·35 to 1·52 and in breadth from 1·0 to 1·11 inches, but the average is 1·46 by 1·06.

898. THE STILT.

Himantopus candidus, Bonn.

The Stilt or Longlegs is a common cold-weather visitant to all parts of the Presidency, but is said to be rare in Ratnagiri. It is a permanent resident in Sind, Mr. Doig having found it breeding on the salt deposits on the Eastern Narra in June.

Mr. Hume gives a concise account of their breeding at the Salt Works at Sultanpur.† He says :—

"They collect together small pieces of kunkar or the broken lime-lining of the pans into a circular platform from seven to even twelve inches in diameter and from two to three inches in height; on this again they place a little grass, on which they usually lay four eggs, but not unfrequently only two or three. They begin to lay, according to season, towards the end of April or the beginning of May, and by the beginning of June numbers of young are to be seen about, and by the 1st July most of the eggs then remaining are hard set. The majority of the birds lay in June, early or late according to season.

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* *Nests and Eggs of Indian Birds*, p. 588.

† *Nests and Eggs of Indian Birds*, p. 589, *et seq.*

"In shape and general appearance they are very lapwing-like, reminding one much of the eggs of *Lobivanellus indicus*; they are, however, as a rule, smaller, more pointed, with less numerous, but more clearly defined markings. In shape they are moderately broad ovals elongated; and in some pinched out, as it were, towards one end, reminding one of the eggs of the Red-shank.

"The texture is very fine and compact, and the eggs have, many of them, a certain amount of gloss, entirely wanting in the Red-wattled Lapwing's eggs. The ground-colour appears to vary as in the Plovers: in some it is a darker or paler olive-brown, in others a greenish-stone colour, or pale *café-au-lait*. The markings consist of specks, spots, blotches, and streaks irregularly sprinkled over the whole surface of the egg, but most thickly so, as a rule, towards the large end. The markings are black, blackish-brown, and rich umber-brown. As a rule, the markings are all clearly defined and are much of the same colour. The secondary markings of pale inky-purple, so characteristic of most of the Lapwings' eggs, are normally almost totally wanting on the Stilt's.

"In length they vary from 1·5 to 1·8 and in breadth from 1·1 to 1·32, but the average is 1·64 by 1·21."

Eastern Narra, Sind. *S. B. Doig.*

900. THE BRONZE-WINGED JACANA.

Parra indica, Lin.

The Bronze-winged Jacana, although probably a permanent resident, occurs but sparingly in the southern half of the Presidency, and appears to be very locally distributed. Mr. Hume gives his opinion that the Bronze-winged Jacana does not occur in Sind, Cutch, Kathiawar, Jodhpore, or in part of Rajpootana. I can only say that Mr. Littledale found them breeding at Baroda, and that I found them breeding at the Milana tanks near Deesa, and abundantly on all the large tanks near Neemuch. I have not seen it in Sind.

They breed from the latter end of May to the beginning of October, but the months in which the majority lay are June and July.

The nest, composed of rushes and weeds, is usually placed on a floating lotus leaf; occasionally they deposit their eggs on a heap of floating weeds, without preparing any nest at all.

The normal number of eggs is certainly four, but they are stated to lay from eight to ten.* I have had exceptional facilities for noting this bird, and must have examined hundreds of nests; I never found more than four eggs in a nest. A clutch of five was once brought to me by a fisherman, which, he stated, all came from the same nest. I also note that Mr. Doig found a nest containing five eggs, but these are exceptional cases.

The eggs are oval in shape, pointed at one end, and are generally of a rich *café-au-lait*. One clutch I have has the ground-colour a dark olive-brown, while in another it is very pale stone-brown; the eggs of this last clutch are abnormally small.

The markings consist of a net-work of entangled lines, and vary from deep blackish-brown, at times almost black, to a deep reddish-brown.

The eggs are highly glossy and are extremely handsome. They measure 1·47 inches in length by nearly 1·02 in width.

Deesa (Milana), June.	*H. E. Barnes.*
Neemuch, July and August.	*Do.*
Saugor, C. P., May to October.	*Do.*
Baroda, August and September.	*H. Littledale, B. A.*

901. THE PHEASANT-TAILED JACANA.

Hydrophasianus chirurgus, Scop.

The Pheasant-tailed Jacana occurs in suitable localities throughout Western India, but appears to be much less common in the southern half of the Presidency. It is, I believe, a permanent resident where found, flocking together as the breeding season approaches and retiring to the nearest suitable spot to breed. In many places it is spoken of as being a cold weather visitant. Thus at Deesa, for instance, Colonel Butler says that nearly all the birds leave that part of the country at the end of the cold weather, yet I found them breeding abundantly on the Milana jheels only 18 miles away. Mr. Littledale found them breeding also near Baroda, and on all the tanks and jheels of any size near Neemuch they breed in great numbers.

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* *Bombay Natural History Society Journal*, Vol. I., p. 221.

The nest, composed of weeds and aquatic plants, is placed on a floating mass of decaying vegetable matter, amongst thick reeds and rushes; sometimes the nest is smaller and is placed on a lotus leaf. The eggs, four in number, are peg-top shape, and are of a glossy-rufous or greenish-bronze colour; often they are almost black. When hard-set they lose their glossy appearance and become much paler in colour. They measure 1·46 inches in length by about 1·1 in width.

Deesa (Milana), July to September.	*H. E. Barnes.*
Neemuch, August to September.	*Do.*
Baroda, September.	*H. Littledale. B.A.*
Sind (E. Narra), July to August.	*S. B. Doig.*

902. THE PURPLE COOT.

Porphyrio poliocephalus, Lath.

The Purple Coot appears to be uncommon in the Deccan, and only occurs as a straggler in other parts of the southern half of the Presidency. Further north, in Rajpootana, Guzerat, Sind, and the northern half generally, they are very abundant (in suitable localities), breeding freely from June to the beginning of October. Eggs may be found both earlier and later, but the majority lay in the months named.

They frequent reedy, rushy, and lotus-covered jheels and swamps. In the early morning they come out to feed, and may be seen on the borders of the jheels or edges of the tanks, sometimes on the shore, walking about sedately and jerking their tails at every step, just like the water-hens do; at other times they keep in the shallow water, but as soon as the sun is well up they all retire to their usual haunts in the dense beds of rushes and reeds that fringe the border of the jheels and lakes. Here they keep up such an incessant row that it gives one the idea that they are quarrelling and fighting.

The nests, built of rushes and reeds, are floating, but not free; occasionally on the ground, often they merely trample down the rushes and form a kind of platform, and on this they make the nest.

The eggs, five to eight in number, are normally of an oval shape, but are subject to much variation; they vary considerably also in size, but the average is about 1·93 inches in length by nearly 1·4 in breadth.

Mr. Hume says* all the birds in the same swamp both lay and hatch off about the same time, and that in two different jheels only a few miles apart there may be a difference of fifteen days or so in the periods of laying in the two colonies. My experience is very different. I have often taken fresh and incubated eggs from the Milana jheels, and at the same time have seen good-sized chicks in the water. Again in the tanks near Neemuch I noticed the same; and on the Saugor lake I have taken eggs from June to October; and although I did not go there so often, still I have taken fresh and incubated eggs at the Chundrapur lake, 22 miles away. Mr. Littledale notes that he found nests on the 28th and 29th September containing 4, 1, 2, and 5 eggs, respectively, and one containing 4 chicks and two eggs; of these the clutch of five was much incubated, but the others were fresh; we may therefore conclude that in Western India they do not breed simultaneously, whatever they may do elsewhere. The eggs vary from a pale pinkish-stone colour to pure salmon-pink, but they fade very soon; they are thickly sprinkled, speckled, and blotched with red-brown and secondary markings of pale purple.

Neemuch, August to September.	*H. E. Barnes.*
Deesa, July to September.	*Do.*
Baroda, September.	*H. Littledale, B.A.*
Sind, Eastern Narra, June to August.	*S. B. Doig.*

903. THE BALD COOT.

Fulica atra, Lin.

The Bald Coot is common in suitable localities in Western India, but is now rare in Ratnagiri, and some other places in the southern half of the Presidency.

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* *Nests and Eggs of Indian Birds*, p. 594.

It is, I believe, a cold weather visitor to most places; Colonel Butler found a nest at Belgaum, and Lieut. Burgess found one containing three eggs on the Singwa tank, 18 miles north of Ahmednuggur; these are, I believe, the only recorded instances of the nest having been taken within our limits. It most probably breeds on the Munchur lake in Sind and on some of the larger lakes in Rajpootana. I shot a pair during the rains on a small pool of water near Ooria on Mount Aboo, and have once or twice seen them on the Aboo lake.

Mr. Hume says* that they breed throughout India in large jheels and lakes that contain water all the year round. The nests are sometimes very large conical masses of reeds, rushes, and weeds, built amongst beds of rushes and rice, in water from six to eighteen inches deep, but based on the ground, and rising several inches above the water level, those built in shallow water are less massive. They breed during July and August. The eggs, from seven to ten in number, vary greatly in size and shape, but are very uniform in colour, and in the character of the markings; they have no gloss. The ground-colour is a pale buffy-stone, and the whole surface is closely and evenly stippled with black and blackish-brown specks.

They average 1·98 inches in length by 1·4 in breadth.

904. THE WATER COCK.

Gallicrex cinereus, Gm.

The Water Cock occurs sparingly in some parts of Sind; it has not been recorded from any other part of Western India.

I shot a female with the ovaries much developed, during the rains, near Hyderabad, Sind, and have a clutch of eggs, said to have been taken in the Province. These were given to me by a friend who could give me no particulars as he did not take himself, but he was sure that they were taken in Sind, because the person who gave them to him had a local collection only.

Mr. Doig had reasons for thinking that they bred during June in the Eastern Narra, but I am not aware whether he ever succeeded in finding eggs.

The nest is said to resemble that of the Coot, but to be much smaller, and occasionally to be only a slight one, composed of fine rushes and grass, placed on a floating lotus leaf.

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* *Nests and Eggs of Indian Birds*, p. 595.

The eggs are oval in shape, fine and compact in texture, but not glossy; the ground-colour is very pale yellowish-white, thickly blotched and streaked with red-brown and brownish-purple. They measure 1·7 inches in length by ·27 in breadth.

The number of eggs is said by boatmen and others to be eight or ten; Mr. Hume personally never found more than five, and Mr. Irwin found two nests—one containing two fresh and the other containing two incubated ones. My clutch consists of four eggs.

905. THE WATER HEN.

Gallinula chloropus, Lin.

The Water Hen occurs sparingly in suitable localities throughout Western India; it is more common in Sind than in any other part of the Presidency.

They breed during the rains, making an untidy nest of reeds and rushes, placed sometimes on the lower branches of trees, growing in the water, but generally amongst the reeds and rushes that fringe the borders of so many of the tanks and jheels.

The eggs, from five to nine or ten in number, are oval in shape, compact in texture, but not glossy; the ground-colour is a pale stony drab or whitish-brown, more or less sprinkled with spots, specks, streaks, and small blotches of reddish-brown and purple. They measure 1·62 inches in length by about 1·21 in width.

Milana, near Deesa, July.	*H. E. Barnes.*
Hyderabad, Sind, June to August.	*Do.*
Eastern Narra, Sind, June.	*S. B. Doig.*

907. THE WHITE-BREASTED WATER HEN.

Erythra phœnicura, Penn.

The White-breasted Water Hen occurs in all parts of Western India, that is, of course, in suitable localities.

They are found chiefly in thickets and wooded nullas, especially when the banks are rugged and steep; along hedge-rows and patches of jungle near water. They may often be seen in the morning creeping silently about amongst the reeds and rushes on the borders of a tank or nulla or in the shallow bed of a stream, coming out occasionally in the open, one moment walking along in a dignified manner, pecking here and there amongst the gravel, the next for no apparent reason running rapidly away, always with the tail erect, rarely taking flight.

They climb into and creep about the dense thorny thickets with the greatest ease. After they have hidden themselves in one of these places of refuge, they are very difficult to dislodge. I have even had to poke them out with a long stick before I could make them move.

They breed from May to August. The nests are, as a rule, placed in the branches of dense bushes or trees close to the water, occasionally some distance away. The nest is generally an untidy mass of weeds and rushes. Sometimes the nest is built amongst the reeds and rank grass on the ground.

The eggs, from four to seven in number, are subject to much variation in shape, size, and colour; these differences exist even in eggs of the same clutch. Normally they are moderately broad ovals in shape, measuring 1·6 inches in length by about 1·18 in breadth; the ground-colour is a pale pinkish-stone, darker or lighter in different specimens, beautifully marked, as a rule, with bright reddish-brown and brownish-purple streaks and blotches.

Some eggs are almost devoid of markings.

Deesa, July.	*H. E. Barnes.*
Neemuch, May to August.	*Do.*
Vehar Lake, Bombay, August.	*Do.*
Baroda, August to September.	*H. Littledale, B. A.*

908. THE BROWN AND ASHY CRAKE; OR THE BROWN RAIL.

Porzana akool, Sykes.

The Brown Rail is a not uncommon permanent resident in Guzerat and in some part of Rajpootana. I do not think that it occurs in Sind, and it is decidedly rare in the Deccan, but is more common about Belgaum.

I think they are permanent residents where they occur. Colonel Butler procured eggs at Belgaum, and I found a nest containing five eggs at Milana, 18 miles from Deesa, and I have also taken eggs at Saugor, in the Central Provinces.

I think they have two broods in the season—the first in May and June, the other later on in August and September.

The nest is not unlike that of the Common Water Hen, but is, of course, much smaller, and is placed in similar situations.

The eggs, from four to eight in number, are broad ovals in shape, slightly compressed at one end; they measure 1·49 inches in length by about 1·18 in breadth. The ground-colour is white, with a barely susceptible tinge of salmon-pink, which is very evanescent; the markings consist of streaks and spots of purplish and reddish-brown with underlying blotches of faint purple. The texture of the shell is fine, but they have scarcely any gloss. They are similar in their habits to the Common Water Hen, skulking amongst long grass and bushes, and are with difficulty flushed. They occur on the hills as in the plains.

Milana, near Deesa, August. *H. E. Barnes.*

910. THE PIGMY RAIL.

Porzana bailloni, Vieill.

Baillon's Crake, or the Pigmy Rail, appears to be not uncommon in most parts of the Presidency, but appears to be very locally distributed. Most of the birds are probably cold-weather visitants, as the nest has been taken so seldom. At Milana, near Deesa, they are very common, breeding from July to September.

The nest is similar to that of the Water Hen, but is very much smaller, and is placed amongst the bulrushes, two or three feet above the water; others are placed just above the water, amongst rank grass and reeds.

The eggs, six to eight in number, are oval in shape, slightly pointed at one end; the ground-colour is pale olive-stone or greenish-drab with faint dusky clouds and streaks, chiefly at the larger end; they measure 1·2 inches in length by nearly 0·81 in breadth.

Milana, Deesa, July to September. *H. E. Barnes.*

913. THE BLUE-BREASTED BANDED RAIL.

Hypotanidia striata, Lin.

I do not think that the Blue-breasted Banded Rail occurs north of Bombay; it appears to be not uncommon in many parts of the Deccan, breeding during August and September. I have never seen a nest, and cannot find a description of one.

The eggs in my collection were taken in a reedy swamp near Khandala during August. The eggs, three in number, were perfectly fresh, and the bird would probably have laid more. These eggs are broad ovals, of a pale brownish-stone colour, much blotched at the large end with brownish and cinnamon-red and purplish-grey; they measure 1·3 inches in length by 1·02 in breadth.

917. THE BLACK-NECKED STORK.

Xenorhynchus asiaticus, Lath.

The Black-necked Stork appears to be very uncommon in the Deccan and south generally, but is more common towards the north, frequenting the borders of tanks and jheels, and the banks of rivers and streams.

It is a permanent resident, breeding just after the rains are over, that is, about the beginning of September, and eggs may be found quite up to the middle of December.

The nest is very massive and is saucer-shaped, composed of sticks well lined with grass, rushes, and water weeds. It is placed on the top of a high tree.

The eggs, four in number, occasionally three only, more rarely five, are typically broadish ovals in shape, compressed at one end, but are subject to variation. When fresh the eggs are almost pure white, but soon become discoloured, and are then a dingy yellowish-white. In size they vary a good deal, but the average is 2·9 inches in length by about 2·12 in breadth.

Deesa, October.	*H. E. Barnes.*
Baroda, September.	*H. Littledale, B.A.*
Sind, Eastern Narra, October to December.	*S. B. Doig.*

920. THE WHITE-NECKED STORK.

Dissura episcopa, Bodd.

The White-necked Stork is fairly common in suitable localities throughout Western India, frequenting the banks of rivers, borders of swamps and jheels, open plains in well-watered districts, and such-like places.

They are permanent residents, breeding from August to December, making a saucer-shaped nest of sticks and twigs, lined with straw, leaves, feathers, &c.

The eggs, usually four in number, vary considerably in shape, some being broad ovals compressed at one end, others are long narrow ovals equally pointed at both ends. They are faint bluish-white in colour, sometimes pure white when perfectly fresh, but they soon get discoloured, and when they are much incubated, they present an uniform yellowish earthy-brown appearance. They average 2·5 inches in length by about 1·83 in width.

Baroda, September. *H. Littledale, B.A.*
Sholapur, December. *J. Davidson, C.S.*

923. THE BLUE HERON.

Ardea cinerea, Lin.

The Blue Heron is common in suitable localities throughout the Presidency. I cannot find any record of its nest having been taken in the Deccan, and Mr. Vidal notes it as a cold weather visitant only to Ratnagiri. They breed freely in the Eastern Narra in Sind, and in parts of Guzerat and Rajpootana.

They breed in colonies generally in company with other water birds. The nest is a platform of sticks, with a depression in the centre in which the eggs are placed; this hollow is occasionally lined with grass.

The eggs, three in number, are moderately broad ovals in shape, and are of a glossless bluish-green colour, which fades rapidly, especially if at all exposed to the light.

They measure about two and a quarter inches in length, by almost one and three quarters in breadth.

Deesa, August. *H. E. Barnes.*
Sind, Eastern Narra. *S. B. Doig.*

924. THE PURPLE HERON.

Ardea purpurea, Lin.

The Purple Heron, although not so common as the Blue Heron, occurs in suitable places in all parts of the district. It is stated to be a cold weather visitant only to the Deccan and Ratnagiri.

I have never myself seen a nest in Western India, but I have taken the eggs at Saugor, in the Central Provinces, in the hot weather.

They frequent dense beds of rushes and high reeds in swamps and marshes, and are seldom seen far from water.

As a rule they breed in colonies amongst these reeds, but occasionally also in trees in company with other water birds.

The eggs, four or five in number, are very similar to those of the Blue Heron, but are rather smaller, averaging 2·17 inches in length by about 1·56 in width.

Sind, Eastern Narra.	*S. B. Doig.*

925. THE LESSER WHITE HERON.

Herodias torra, B. Ham.

The Lesser White Heron, or, as Jerdon called it, the Large Egret, occurs on all the rivers and marshes in Western India, abundantly in Sind, less common elsewhere.

It is probably more or less a permanent resident, but I am not aware of the nest having been taken in the southern half of the district.

I saw several pairs on a tall tamarind tree, growing in the compound of a hut, close to the railway station at Wassind, about fifty miles from Bombay. This was in the latter part of July, and the tree was crowded with nests of the Little White Heron (*Herodias intermedia*); the Little Egret (*Herodias garzetta*); Cattle Egret (*Bubulcus coromanda*); and the Pond Heron (*Ardeola grayi*); all these were sitting on their nests; but although I watched them through my binoculars for a very long time, I did not see a single Large Egret on a nest, so I cannot be sure that they were breeding, although in all probability they were.

It is this habit the Herons have of breeding in company that causes so much confusion amongst their eggs in collections.

The nest is a loose ragged platform, constructed with sticks and twigs, with scarcely any hollow for the eggs, which are from three to five in number, and are very similar to those of the Blue and Purple Herons, but average rather smaller. They measure about 2·11 inches in length by 1·55 in breadth.

Baroda, July to August.	*H. Littledale, B. A.*
Sind, Eastern Narra, July to August.	*S. B. Doig.*

926. THE LITTLE WHITE HERON.

Herodias intermedia, Hass.

The Little White Heron has a similar distribution to the last; the nest does not appear to have been taken in the Deccan. It is common in the northern portion of Western India, and breeds freely on trees in colonies.

The eggs are similar to those of other Herons, but are perhaps rather finer in texture, and slightly paler.

They measure 1·9 inches in length by 1·44 in breadth.

Wassind, near Bombay, July.	*H. E. Barnes.*
Baroda, July and August.	*H. Littledale, B. A.*
Sind, Eastern Narra, July and August.	*S. B. Doig.*

927. THE LITTLE EGRET.

Herodias garzetta, Lin.

The Little Egret is found in the same localities as the other herons, and like them they seem to disappear from the Deccan during the breeding season.

I found them breeding at Wassind in July and at Deesa in July and August. In the latter case the nests, of which there were a great number, were all built in a large tree about two hundred yards from the river, and in the middle of a block of huts on the outskirts of the town. The Cattle Egrets and Pond Herons were also breeding in the same tree. The nests were like those previously described, and the eggs, five or six in number, were of a pale blue colour, which however soon faded. They averaged 1·73 inches in length by 1·52 in breadth.

Deesa, July to August.	*H. E. Barnes.*
Wassind, near Bombay, July.	*Do.*
Baroda, July.	*H. Littledale, B.A.*
Sind, Eastern Narra, July and August.	*S. B. Doig.*

928. THE ASHY EGRET.

Demiegretta gularies, Bose.

The Ashy Egret or White-throated Reef Heron occurs along the sea coast; it is very abundant near Kurrachee, and is said to breed on the tops of the mangrove bushes in the harbour, making a slight stick nest, some five or six feet from the high water level.

The eggs in my collection measure 1·68 inches in length by 1·3 in breadth.

They are rather paler in colour than those of the last.

929. THE CATTLE EGRET.

Bubulcus coromandus, Bodd.

The Cattle Egret is more or less common in all suitable localities in Western India. Some of them remain to breed in the Deccan, but most of them appear to leave that part of the country at the approach of the breeding season.

They are very common in the whole of the northern half of the Presidency, where they are permanent residents, breeding freely during July and August; occasionally a colony may be found to consist of them alone, but generally they breed in company with other species.

The eggs, four or five in number, may be distinguished from those of all other herons by their excessive paleness. They being white, with a faint tinge of blue or green, much resembling in colour the eggs of the Shikra (*Astur badius.*)

They measure 1·17 inches in length by 1·32 in breadth.

Deesa, July and August.	*H. E. Barnes.*
Wassind, near Bombay, July.	*Do.*
Baroda, July.	*H. Littledale, B.A.*
Sind, Eastern Narra, July and August.	*S. B. Doig.*

930. THE POND HERON.

Ardeola grayi, Sykes.

The Pond Heron is a common permanent resident in all parts of the country, breeding from May to August; making a platform-nest of sticks and twigs on trees, sometimes isolated, at other times in small colonies, and often in company with other species of herons.

The eggs, four or five in number, are deep sea-green or bluish-green in colour; they are oval in shape, compressed a little at one end, and measure 1·48 inches in length by about 1·17 in breadth.

I found a small colony at Neemuch, in a large banian tree growing over a small but deep masonry well in the middle of a village and quite a mile from any other water.

Deesa, May to August.	*H. E. Barnes.*
Neemuch, June to August.	*Do.*
Sind, Hyderabad, July.	*Do.*
Sind, Eastern Narra, June and July.	*S. B. Doig.*
Baroda, May to July.	*H. Littledale, B.A.*

931. THE LITTLE GREEN BITTERN.

Butorides javanica, Hors.

The Little Green Bittern or Heron is a not uncommon permanent resident throughout the district.

They frequent secluded well-wooded nullas, banks of rivers and mangrove swamps; they remain hidden all day in some densely-foliaged tree or other thick cover, coming out at sunset to feed; owing to this habit they appear to be much less common than they really are.

They breed from June to August, making a small stick nest which is always well hidden. Those I have found have always been placed on trees or bushes overhanging water, but I believe they do occasionally place them amongst tall reeds and rushes.

The eggs, three or four in number, are pale sea-green or greenish-blue in colour, oval in shape, compressed as a rule at one end, and measuring 1·62 inches in length by 1·35 in breadth.

They are, I believe, always solitary.

Deesa.	*H. E. Barnes.*
Neemuch.	*Do.*
Sind, Hyderabad.	*S. B. Doig.*

The following table may be of some use, as it gives the average dimensions of the eggs, but they are so much alike that it is advisable always to shoot a bird off the nest to avoid mistakes :—

Jerdon's number.	Name.	Dimensions of Eggs.		Colour.
		Length.	Breadth	
923.	Ardea cinerea	2·27	1·66	Delicate bluish-green.
924.	Ardea purpurea	2·17	1·56	Do.
925.	Herodias torra	2·11	1·55	Do.
926.	Herodias intermedia	1·90	1·44	Do., but paler.
927.	Herodias garzetta	1·73	1·32	Do. do.
928.	Demiegretta gularis	1·68	1·30	Do., but still more pale.
929.	Bubulcus coromandus ...	1·71	1·32	White, faintly tinged blue or green.
930.	Ardeola grayi...............	1·48	1·17	Sea-green or greenish-blue.
931.	Butorides javanica	1·62	1·21	Greenish-blue.
937.	Nycticorax griseus.........	1·92	1·35	Do.

932. THE BLACK BITTERN.

Ardetta flavicollis, Lath.

I do not think that the Black Bittern has been recorded from anywhere in Western India, with the exception of Sind, where Mr. Doig found it breeding in June and July. He says :—*

"The nests are formed of tamarisk twigs, with some few aquatic weeds, on which the eggs are laid ; they are generally placed about five feet over the water, either in a dense tamarisk bush or thick clump of reeds, and are about 9 inches in diameter and three inches in thickness, and have a very slight depression, in which the eggs, always four in number, are laid. The eggs are for the most part very broad ovals, sharp at both ends, and very nearly white in colour. The eggs vary in length from 1·5 to 1·85 inches and in width from 1·15 to 1·3, the average length of 53 eggs being 1·66 and width 1·26."

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*Stray Feathers, Vol. VIII., p. 377.

933. THE CHESTNUT BITTERN.

Ardetta cinnamomea, Gm.

The Chestnut Bittern is common at Belgaum, where it breeds during the rains.

Mr. Doig found it to be not uncommon in the Eastern Narra district, where also it breeds. It is probably very rare, even if it occurs at all in most other parts of Western India.

Mr. Doig, referring to a nest he found in the Eastern Narra, writes:—

"Found a nest of this species on the 3rd August in a thick clump of reeds in the middle of a swamp: it contained four fresh eggs. The nest was a platform of coarse grass and reeds. The eggs were nearly perfect ovals of a chalky-white colour." (*Stray Feathers*, Vol. IX., p. 282.)

934. THE YELLOW BITTERN.

Ardetta sinensis, Gmel.

The Yellow Bittern is not very common in Sind; it occurs also in Guzerat, but is rare in the Deccan.

Colonel Butler found it breeding at Milana, near Deesa. He writes:—

"On the 21st August, 1876, at Milana, I found a nest of the Yellow Bittern. It was built of sedges and rushes near the outside of an immense bed of tall bullrushes, in one of which it was placed about ten feet from the level of the water. It was a small nest and not unlike that of a small rail, and contained three eggs, but unfortunately so near hatching that I only managed to extract the contents of one of them. The eggs are long and cylindrical, in fact much in shape like Nightjars' eggs, about 1¼ inches in length; white, faintly tinted with skim-milk blue.

"On the 24th instant I found another nest exactly similar in every respect, but built in a clump of bullrushes growing quite on the outside of the bed. The bird rose off the nest within a yard of me, but there were no eggs, and when I returned a few days later the nest was deserted." (*Stray Feathers*, Vol. V., p. 216.)

Sind, Eastern Narra, May to August.	*S. B. Doig.*
Deesa, Milana, August.	*Colonel Butler.*

935. THE LITTLE BITTERN.

Ardetta minuta, Lin.

With the exception of Sind, the Little Bittern does not occur anywhere in Western India. Mr. Doig, who found it breeding in the Eastern Narra, says :—

"I took my first nest of this bird on the 26th May; it contained four fresh eggs. They are elongated ovals, pointed at both ends and pure white. The eggs vary from 1·3 to 1·4 in length and from 0·95 to 1·05 in width; the average of seven eggs being 1·34 in length and 1·00 in width." (*Stray Feathers*, Vol. VIII., p. 379.)

937. THE NIGHT HERON.

Nycticorax griseus, Lin.

The Night Heron is a common permanent resident in all suitable localities in Western India. It is particularly common on the islands in the Vehar Lake, where it breeds, as also in the island of Elephanta in Bombay Harbour.

They breed from June to August in colonies, on large trees, often in company with other species.

The eggs, four or five in number, are greenish-blue in colour quite as deep as those of the Blue Heron. They vary a good deal in shape and size, but typically they are ovals, measuring 1·92 inches in length by rather less than 1·35 in breadth.

Bombay; Vehar, August.	*H. E. Barnes.*
Sind, Hyderabad, July and August.	*Do.*
Sind, Eastern Narra, June and July.	*S. B. Doig.*

938. THE PELICAN IBIS.

Tantalus leucocephalus, Forst.

The Pelican Ibis is generally distributed throughout the Presidency, with the exception of Ratnagiri and Kanara, where I believe it does not occur.

They are permanent residents, breeding at very different times in different places. In the Deccan, Lieutenant Burgess records them as breeding in February; Mr. Littledale found them breeding near

Baroda in October; Mr. Doig says that in the Eastern Narra District they breed in October and November.

Personally I know of only one breeding place, and that is at the village of Hir, about ten miles from Neemuch; at this place they breed early in March.

The river runs for some distance between high sloping well-wooded banks; here and there where the banks are low, or rather where there is no bank at all, the river widens out into broad shallows; the village stands on a high rocky bank; the water on the village side is very deep, and runs some distance under the bank which is shelving, but on the opposite side is a low sandy plain, and the river forms a broad shallow lake which teems with fish. There are a great many very high trees, some of them in the village itself, and on these trees there were some fifty or sixty nests.

Considering the size of the birds, these nests seemed very small; they were constructed of sticks and twigs, and are mere platforms quite unlined. The eggs (I have never found more than four in a nest, but they were fresh, and possibly the birds may lay more) were elongated ovals in shape, pointed at one end; they are fine and compact in texture, and are unspotted, white in colour. They vary considerably in size and shape, but the average of a large series was 2·76 inches in length by about 1·9 in breadth.

Baroda, October.	*H. Littledale, B.A.*
Sind, Eastern Narra, October and November.	*S. B. Doig.*
Neemuch, March.	*H. E. Barnes.*

939. THE SPOONBILL.

Platalea leucorodia, Lin.

Generally speaking, the Spoonbill is fairly common in Western India, but appears to be somewhat rare in Ratnagiri and Kanara.

They breed in Sind during the months of October and November.

I have no reliable information of their breeding in any other portion of the Presidency, but they undoubtedly do so. I heard of a colony at Naigaum, near Neemuch, but was unable to verify the fact, and I have been informed that they breed freely in the Runn of Cutch.

Occasionally a few pairs may be found breeding by themselves, but, as a general rule, as the breeding season draws near, they assemble together and form immense colonies.

The nests, which are placed on high trees, are large stick platforms two or three feet in diameter.

The eggs, four or five in number, vary much in size and shape, but typically they are elongated ovals, much pointed at one end; they average 2·7 inches in length by 1·81 in breadth. In texture they are rather coarse and slightly chalky; when fresh the ground-colour is a glossless white, but gets soiled as incubation proceeds. The markings are usually scanty and almost confined to the large end. They are ill-defined and consist of smudgy spots and blotches of a dingy yellowish-brown or rusty-red colour; occasionally they are bright or reddish-brown, rarely almost black.

Sind, Eastern Narra, October and November. *S. B. Doig.*

940. THE SHELL IBIS.

Anastomus oscitans, Bodd.

The Shell Ibis appears to be not very common, and does not, I believe, occur at all in Kanara and Ratnagiri. They are more common in Sind when they breed.

They form large colonies, placing their nests, which are large stick platforms as a rule, on the topmost branches of high trees, but in Sind they breed in thickets, and the nests are only a few feet above the water.

The eggs, four or five in number, are usually oval in shape, but are subject to variation. When first laid they are spotless creamy-white, but as incubation proceeds they turn to a dull earthy or yellowish-brown. The texture is smooth and close. They average about 2·24 inches in length by 1·6 in breadth.

Sind, Eastern Narra, October and November. *S. B. Doig.*

941. THE WHITE IBIS.

Ibis melanocephala, Lath.

The White Ibis is fairly common in suitable localities in all parts of the Presidency, and is probably more or less a permanent resident where they occur.

They form small colonies generally by themselves, occasionally associated with other species.

The nests, made of sticks and twigs, are moderately sized platforms having a central depression, and are placed in high trees.

The eggs, two to four in number, are subject to much variation, size and shape, but are typically elongated ovals. Mr. Hume says that his longest egg measured 2·82 inches, the shortest 2·1; the broadest was 1·82, the narrowest 1·5, and that the average of over one hundred eggs was 2·54 inches by 1·7.

When fresh laid they are delicate bluish or greenish-white, but soon become soiled; most of the eggs are plain, but some are spotted with yellowish-brown.

Sind, Eastern Narra, October to December. *S. B. Doig.*

942. THE BLACK IBIS.

Inocotis papillosus, Tem.

The Black or Warty-headed Ibis is a common permanent resident in most parts of Western India; it does not occur in Ratnagiri or the more southern portion of the district generally.

It is often called the King Curlew.

The nests are as a rule solitary, but occasionally two or three will be found in close proximity; it is placed as a rule in a fork near the top of a high tree, and is composed of twigs and sticks, and the egg cavity, which is often three inches deep, is lined with fine twigs and straw. Sometimes they take possession of an old nest of the Fishing Eagle or King Vulture.

The eggs, three or four in number, are usually moderately long ovals in shape, more or less compressed at one end; they are subject to much variation in size, but the average is 2·43 inches in length by about 1·7 in width.

In colour they are deep sea-green, as a rule unspotted, but occasionally they are thinly specked and streaked with brown or yellowish-brown.

I am inclined to believe that they have two broods in the year.

Sholapur, November and December. *J. Davidson, C.S.*
Deesa, October. *H. E. Barnes.*
Sind, Eastern Narra, June to October. *S. B. Doig.*

943. THE GLOSSY IBIS.

Falcinellus igneus, S. G. Gmel.

The Glossy Ibis is not uncommon in Sind, and occurs in some parts of Guzerat and Rajpootana.

Mr. Vidal found them on the river near Satara, and Mr. Davidson has recorded a single specimen from near Sholapur; these are the only instances that I can find of its occurrence in the southern half of the Presidency.

Mr. Doig found them breeding in June and July in the Eastern Narra, and I am indebted to him for a clutch of their very beautiful eggs; he says:—

"In May, 1878, I observed these birds in pairs, and sent men after them to find their breeding grounds but in vain, and so being unable to go myself, in consequence of work, I was obliged to give up the search. This year (1879), however, in June I was able to search myself, and found them breeding in great numbers on trees along the banks of the large lakes inside the sand hills along the banks of the "Narra." The nests were found in the tops of Kimdy trees, and were constructed of sticks, about the size of those of *Plotus melanogaster;* on the same trees I found *Inocotis papillosus* and *Ibis melanocephalus* breeding, while close by were numbers of nests of Herons, Egrets, and Cormorants.

"The eggs are of a beautiful green colour, roughly pitted over with slight indentations giving the shell a rough appearance; they are oval in shape, pointed at both ends.

"The normal number of the eggs is three, and they vary from 1·8 to 2·15 in length, and from 1·3 to 1·55 in width, the average of thirty-five eggs being 2·01 in length and 1·4 in width." *(Stray Feathers,* Vol. VIII., p. 377.*)*

BOMBAY FERNERIES.

By G. H. Carstensen, Superintendent, Municipal Gardens.

(*Read before the Bombay Natural History Society on 31st March 1891.*)

A few months ago, I had the honour to read before this Society a paper, entitled "Bombay Gardens." The subject then dealt with is, however, so wide and comprises so many various features, that it was not possible on that occasion to do more than merely allude to what in Bombay are generally called Ferneries. These possess however in themselves so many interesting features, that they quite deserve to be dealt with as a separate subject, though many of the remarks preceding the sketch of Bombay Gardens refer equally well to our Ferneries, and are quite necessary for explaining several circumstances that might not be found sufficiently clearly accounted for. This paper should, therefore, be taken as a continuation and complement to the paper on Bombay Gardens.

Bombay Ferneries correspond, to a certain extent, with our conservatories, greenhouses, store and hot-houses at home, in that by their aid it is possible to cultivate a great number of plants, which, under ordinary circumstances, could not at all, or at least only with the greatest care, be grown in Bombay Gardens. The number and variety of plants for which these structures are essential or at least beneficial, is so great and their uses for decoration so important for the embellishment of our rooms and verandahs, that Ferneries will deserve the attention of every inhabitant in Bombay who is fond of a bright and cheerful home.

The name Fernery is undoubtedly, to a certain extent, misleading, as it applies to any structure calculated to afford shelter, and a somewhat different climate to any kind of plant, and not only to structures exclusively devoted to the cultivation of ferns. Such words as plant-shed, plant-house, or conservatory, would be far more correct expressions, if it were not for the fact that structures bearing these names at home are of so entirely different a character that the use of these terms would easily convey a wrong idea. In other parts of India, where different materials are used in the construction of Ferneries, such names as grass-house, betel house, chick-house, lattice-house, &c., are applied, and following this system we might call our Bombay Ferneries "coir-houses," but it is not a well-sounding name and would be as much Greek to people unacquainted with Bombay as "grass-house" is for most Bombayites. It will, therefore, I believe, be preferable to retain the well-sounding name of Fernery, except in such cases, which however still are almost unknown in Bombay, where the structure is devoted to a single class of plants only, such as ferns, orchids, palms or others, when the proper terms would of course be fern-house, orchid-house, palm-house, &c.

Before considering the construction of such ferneries, it may be advisable to study the natural conditions under which the plants we wish to cultivate are found in a wild state. For this purpose we may class our plants into three groups: ferns, foliage-plants, and orchids. We all know that the best places to search for ferns are the ravines of our hills, near water-courses which in the monsoon often assume the character of picturesque waterfalls or raging torrents, while during the dry season a few brown pools here and there among the boulders, peculiar hollow depressions in the solid rock or the chaotic masses of fragments of rocks, of boulders and pebbles everywhere obstructing our way through the jungle, remain as the only traces of the roar and the splash of the immense volume of water that during the rains is hurried down through the ravines, to feed our rivers, to flood the rice fields and indirectly to supply the food to by far the greater proportion of this densely populated country. These waterways are always distinguished by a peculiar vegetation, as if nature herself would mark out their importance, by here strewing her choicest ornaments of the vegetable world. Among beautiful evergreen trees and often conspicuous flowering shrubs and herbs, but always in more or less shaded positions, we here find the favourite resorts of most of our ferns; and here also we may look for many of our *Begonias*, which both by their graceful flowers and by their varied and often highly ornamental leaves, are such valuable additions to our Ferneries. A practical examination of these localities teaches us that a rocky soil, shelter, shade, moisture, and at certain seasons an ample supply of water, are the principal points in favour of this peculiar vegetation. The great accumulation of fragments of rocks, of boulders and stones is however quite the essential feature in this respect, as it causes large quantities of moisture to be retained, favours a constant and rapid evaporation, resulting in coolness of the air, while at the same time the heat-absorbing powers of the rocks and boulders act as a safeguard against sudden changes of temperature. Several ferns, and amongst them some of the largest growing kinds as the brake fern, the *Marattia fraxinea* and others, are however found in quite different localities, or are, as the common silver-fern, not particular as to habitat, but in such cases their periods of growth and rest are generally very marked, and their growing period generally limited to the rainy season.

A few foliage plants are found in the same localities as ferns, but by far the greater number prefer a deeper soil and a warmer and denser atmosphere than that at their disposal in such places. Their favourite resorts are hot moist valleys or plains, overshadowed by tall-growing trees, where the soil is deep and principally composed of mouldering leaves and twigs, where the dense foliage of the trees above does not easily allow the vapours of the fermenting vegetation, abundantly impounded with dioxide of carbon, to escape. These are the haunts of that dreadful foe, the jungle fever, but just when most dangerous, so fascinating and charmingly attractive that it is difficult to resist an attempt of an intimate acquaintance with their charms. I shall never forget the impression the first view of such a place made upon me—everything seemed new, so perfect was the beauty of every part of the living picture before me. There were gigantic leaves, seen before in hothouses, flowers known from pictures, plants described in books, but all so infinitely surpassing all previous ideas of tropical luxuriance, every detail so much grander, so fascinating and indescribable that I was entirely lost in admiration, and for the first time understood the wonderful effect of a truly tropical vegetation, a fact which until then I had seriously commenced to ascribe to the imagination of such travellers in whose books the howling and roaring of wild animals and the hissing of poisonous snakes are the principal features. Nature has also here, in these dens of fever and malaria, put up her warning sign-posts, in the shape of quaint, but often gigantic and beautiful flowers, exhaling a most repulsive odour. Everybody liable to be attacked by fever, will be wise to take heed of this gratuitous but sound advice, and leave the exploration of this kind of jungle to the dry season, when, however, much of its charm is gone. In such places many highly ornamental foliage plants have their home, while also a few palms and certain kinds of ferns seem to prefer such a locality, where the prevailing conditions are heat and moisture, dense shade, and a rich soil.

It is rather more difficult to refer orchids to specially characteristic localities, their variety is so great, their habits so different, and their requirements so variable, that we may come across representatives of this vast order in almost any locality. Most of the terrestrial, or ground-orchids, prefer open, fully exposed situations, while others appear to prefer shaded and moist localities. Of the epiphytical or tree-orchids, some are met with in covered jungles, others on isolated solitary trees. There appears however to be this difference, that the former generally prefer trees which, at certain times of the year, are next to leafless, while the latter generally are found on trees with dense ever-green foliage. From this fact it appears evident that orchids, though requiring more or less shade, still prefer exposure to sunshine at certain periods of the year, or in the early and late hours of the day. Orchids art not, as a rule, parasitical; it is, however, certain that they prefer certain kinds of trees to others, and are in this Presidency generally found on mango-trees, monkey fig-trees (Umbar, *Ficus glomerata*), iron-wood-trees (*Memecylon edule*), and occasionally on Jambul-trees (*Eugenia Jambolana*) and a few other less common trees. The thick fleshy roots of these orchids generally embrace the branches, often for a great length, they adhere closely to the bark and are frequently surrounded by moss. They have thus always access to moisture, however scanty it may be, partly from atmospheric sources as rain and dew, probably from the bark by diosmosis, and partly from the surrounding moss, which is well known to possess great moisture-absorbing qualities.

These remarks refer to the localities where the plants of the various classes are found in this country. I have, however, but little hesitation in supposing that the same or very similar characteristic features prevail in other tropical countries, from which the multitude of plants cultivated in our Ferneries hail. Descriptions of vegetation in other parts of the world, scattered through the accounts of voyages and travels by various celebrated naturalists, all seem to confirm this view.

Though a close adherence to natural conditions is not generally to be recommended in regard to the culture of plants, and would probably result in eventually reducing our greatly improved cultivated forms, to their original wild state, exception must be made in regard to atmospheric conditions, which, as a rule, do not allow of so much deviation as other local circumstances, such as soil and exposure. It is therefore necessary, in the construction of artificial homes for plants to try as far as possible in these to obtain atmospheric conditions similar to those prevailing in such localities, where the plants these homes are destined to contain, flourish in a wild state. The plants cultivated in Bombay Ferneries do, however, as shown above, differ considerably in their requirements. A structure which unites the greatest number of peculiar advantages for any of these plants will therefore be the most suitable, and to obtain all advantages will only be possible where it is intended to devote a separate structure to each particular class of plants. Modern Bombay Ferneries do, as far as possible, answer all purposes. I am unacquainted with the facts regarding the introduction of coir-matting for the use of ferneries, and regret not to be able to record the name of the person to whom the credit of this innovation is due. It was, however, a most happy idea, by which the character of Bombay Ferneries has been considerably improved, not only in respect to usefulness, but probably also in appearance, as I have little doubt that coir matting in Bombay was preceded by the very ugly and unsightly roofing of split bamboos, which still is commonly used in Poona and other places, and, as I learnt the other day when visiting a rather interesting native garden in Matoonga, has not yet entirely disappeared in Bombay. The great advantages of the use of coir matting are, that it is possible, according to the mesh chosen, to obtain more or less subdued sunlight, that a free circulation of air is guaranteed, while at the same time sufficient shelter from strong winds is provided; that the force of a heavy downpour of rain is lessened, though the quantity of water is not considerably reduced; that moisture is absorbed from the air, and the escape of vapours arising from the ground, tanks and plants inside the structure is checked; finally, a Fernery covered with coir-matting, neatly fixed and well kept in repair, has a fairly good appearance. The only serious drawback of this material is its very limited durability, which in Bombay rarely extends over more than two years. Several kinds of coir-matting, (which I need hardly state is manufactured from the Cocoa-nut fibre) are used for Ferneries. The cheapest kind, which is the only one sold in the bazaar, and is imported from the Malabar coast, is rather too closely woven to be useful for ordinary ferneries, and requires strong supports on account of its comparatively great weight, especially when soaked with water during the monsoon, when its threads also swell out and leave less space for the light to pass through. For structures exclusively devoted to foliage-plants, I should, however, prefer it to the lighter kinds, partly because the denser shade in this instance is beneficial, and partly because the dense texture causes a closer atmosphere in the structure. For all other Ferneries, the coir-matting, manufactured at the local jails, varying in mesh from ¼ to ½ inch, is more suitable. That manufactured at the Tanna Jail is double woven and consequently more expensive (by measure) than that prepared at the Bombay House of Correction, and is generally considered more durable. I have, however, not found its durability sufficiently superior to that of the latter to compensate for its greater original cost. Though the roofing is the most necessary part of a Fernery, the way of fixing and supporting it has also to be considered, and is by no means unimportant. A flat roof is not only unsightly, but also considerably less efficacious in obtaining the full advantages of the coir matting, than a sloping, or an arched roof, which not only affords greater protection against the midday-sun, but at the same time just sufficiently breaks the rays of the morning and afternoon sun. A roof having a slope of 65—70° (the angle formed by the level of the ground and the slope continued till it cuts this line), towards E. and W., will generally be found most useful. The unchecked vertical rays of the sun will only enter such a roof a short time in the morning on one side and a short time in the afternoon on the other side of the structure, so that only one half of the interior of the structure will, at these times, be exposed to the vertical rays, while the other half will only receive oblique and consequently less active rays. The supports of the roof may be of hollow bamboos, rafters, or posts, all depending on available means, desired durability, or other circumstances. A Fernery that is meant to be a permanent structure, should, however, be built of solid teak posts, set in masonry foundations, and connected at the top with a central beam and the ribs of the roof, across which battens should be fixed for supporting the matting. The matting, which is generally procurable in rolls measuring up to 100 yards long and 1 yard wide, should be stretched across the roof from eaves to eaves, and the various lengths sewn together with coir twine. The outer posts should be covered with trellis work, for which teak battens crossing diagonally or strong hand-made wire netting are the most suitable materials. Creepers should be planted along the trellis-work, which they should entirely cover, but they should on no account be allowed to encroach upon any space of the roof. The interior of the Fernery may be variously laid out and disposed of. If the object in view is to cultivate only a few but all excellent specimens of plants, chiefly required for decoration of drawing-rooms, etc., stages, shelves or stands will be found most useful. If, on the other hand, the principal aim is to create a picturesque effect in the Fernery itself, it is desirable to lay out the ground so as to present an irregular surface, and to sink the pots in the ground, a practice which possesses very great advantages for the successful culture of most plants. Another plan, which, as far as possible, meets both objects, is to arrange the plants in groups on the level surface of the ground. The posts should always, when feasible, be covered with creepers, and no Fernery should be without one or more comparatively large water tanks, which not only offer an easily accessible water-supply, but also in a very high degree benefit the plants by keeping the atmosphere moist and refreshingly cool. A regularly shaped Fernery is the easiest to construct, the cheapest, the most economical in respect to space, and the most suitable for the plants we desire to cultivate, and should, except in quite special cases, always be preferred. The interior may however be laid out quite in accordance with the owner's taste. A simple and not at all ineffective way is simply to group the plants round the posts and along the side of the Fernery, leaving sufficient room for paths and passages between them. It requires a little more consideration, and a good deal more individual taste, to arrange the plants so as quite to obscure the strictly regular features of the structure, but this is not impossible, especially if the surface of the ground is here and there slightly varied. The paths in the Fernery should never be less than three feet wide, and should be covered with a thick layer of shells or small pebbles, which besides presenting a neat appearance have similar physical effects as boulders, etc. There are several accessory elements, which may contribute not only to enhance the picturesque effect of the Fernery, but at the same time to benefit the plants. Rockeries, for instance, composed of boulders or clinkers may be constructed so as to be very ornamental, and most useful for the growth of ferns and club-mosses. Clinkers are generally preferred for such work, on account of their irregular shape and because they can easily be procured, but when the principal object is to promote a luxuriant vegetation, fragments of Laterite, of Trap, or even of old masonry will be found to contain more nourishment for the plants, and to possess greater physical advantages than burnt clinkers. It may be here incidentally mentioned that lime-rubbish or old chunam is a very valuable addition to the soil in which it is intended to grow ferns, and serves as a very useful substitute for gravel, which has at home long been considered a beneficial admixture to soil for ferns. Old twisted roots or stumps or even crooked stems of dead trees are useful ornaments; bits of branches are *the* medium on which to grow tree-orchids; hanging baskets of wire, wood, or cocoanut-husks are frequently most effective. Fountains of small dimensions add to the beauty of the Fernery, and produce the pleasant trickling sound which associates so well with vegetation, and refresh and cool the atmosphere. Ferneries formed of certain kinds of growing trees, as of Casuarinas, have been occasionally suggested, but though they may prove serviceable for a great number of plants, it is never possible in such groves or recesses to obtain the same advantages of atmospheric conditions, nor the splendid luxuriance which is often displayed in artificially constructed ferneries.

The Fernery should, where possible, always be built on a site that is sheltered against strong winds, but still sufficiently open to allow the access of the sun during the whole of the day. Overhanging trees should be particularly avoided. The level of the Fernery should be slightly raised above the surrounding ground so as to prevent flooding during the monsoon.

The work required in a well kept Fernery is very detailed and of such a delicate nature, that very few malis will be found sufficiently skilled to perform any but the coarser part of it satisfactorily, and I am quite convinced that we should soon discover a most delightful change in the general appearance of our Ferneries, if the ladies of the house more commonly than at present would spend a short time daily in them, and there find an interesting and pleasant occupation in the care and nursing of their plants. It will perhaps be remembered what excellent specimens of ferns and other plants from Ferneries were exhibited at last year's flower-show, and I should be singularly mistaken if such splendid results were not in several instances due to the tender care of ladies, and as a fact a lady carried off a great number of prizes for particularly well-grown plants. I am not an advocate of the recent proposal, that ladies should enter upon the field as market-gardeners; I know by personal experience that this branch of gardening to be carried out profitably requires a great amount of personal labour for which a lady is physically quite unfit, and that the market-gardener's life is so rough that nobody who is acquainted with it could seriously think of ladies carrying out this calling without at the same time throwing overboard the belief in the many qualities of ladies, by which they are and always will remain superior to men. The work in the Fernery, however, is just suitable for ladies, it principally requires neatness and patience, and to a very great extent a certain kind of nursing; I must however not avoid to mention, that the most serious enemies to the plants are caterpillars, crickets, bandicoots and rats, which however are not of a very savage nature, and certainly do not deserve so much respect, as, I am afraid, most ladies think is due to them. Frogs, toads and occasionally snakes are other inmates of the Fernery, these however should be rather encouraged as they are quite harmless, and do much good. Spiders in charming variety, from the size of a butterfly to almost microscopic dimensions are generally friends of the plants (the red spider has no chance of living in our damp atmosphere) and should not be destroyed as long as their presence does not interfere with the tidy appearance of the plants or the Fernery. The principal work required in a Fernery is potting, propagation, watering, syringing, cleaning and training. Potting should be done carefully, a good rich but porous soil should be used for some kinds of plants, as most foliage plants adding a liberal quantity of decayed manure, while for ferns only fertilisers of vegetable origin, such as leaf mould, rotten fibres of palms, refuse of decayed wood, charcoal, etc., should be used. The pots should in all cases be well drained by a layer of crocks or broken bricks at the bottom, which may with advantage be covered with bits of the fibrous network surrounding the leafstalks of the Cocoanut palm. The soil should not be fine, the coarser and more lumpy it is the better, it should not be rammed firmly in the pots, but be allowed to settle well by shaking and beating the pot against a hard surface, the top layer should be gently pressed and smoothed with the hand. The size of pots naturally varies according to the nature and dimensions of the plants, but in most cases comparatively large sized pots will be found the most useful for full-grown plants in this climate, where frequent re-potting is not advisable, and the evil consequences of over-watering need not to be feared. It is difficult to fix the most suitable season for potting in this country, where this operation may be performed at almost any season without injury to the plants, when sufficient care is bestowed upon them. Where however distinct periods of rest and growth can be easily ascertained, potting should be preferably undertaken when the new growth has just commenced, thus for many ferns in March, for most foliage plants in May and June, and for all tuberous and bulbous plants when signs of renewed vegetation appear. Propagation may be performed at all seasons, for plants in the Fernery it is generally limited to division and the striking of cuttings, in rare instances layering has to be resorted to, and occasionally the sowing of seeds or spores. The necessarily limited space of this paper does not admit of a detailed account of the various processes, which however also seem to be sufficiently known for all general purposes. Watering should be very carefully attended to, and every pot examined, before being supplied with water. No plant should ever be allowed to flag for want of water, but, on the other hand, a certain dryness of the soil is at times beneficial for plants, and nothing is more dangerous than a water-logged soil. To the frequent questions regarding the watering of plants, there is but one reply, to water when the soil is dry, *i.e.*, when it does not leave any touch of moisture when pressed with the fingers. It is quite impossible to lay down a hard and fast rule for the requirements of any particular plant, which can only be ascertained by experience and intimate acquaintance. Watering of the Fernery should be performed in the morning as soon as the heat of the sun has caused the last trace of dew to disappear ; it will then be the best time easily to ascertain what plants are dry and which do not require watering. The best way to apply water is by a small watering-can with a long and pointed spout, but without a rose. By each application of watering the pot should be filled to the brim. Syringing is a work that should always be kept distinct from watering, though it of course considerably lessens the necessity of that operation. An India-rubber hose, a Hydronette, a hand-syringe, or, in the absence of either, the rose of a watering-can may be used for this work. Syringing should be applied on all sunny days, between 10 a.m. and 2 p.m., and during the hot weather when the nights are hot and dry again at about 4 or 5 p.m. The object of syringing is partly to clean the plants from dust, etc., but principally to check a too rapid evaporation of the plants and to produce additional atmospheric moisture. Care should therefore be taken that all parts of the plants are thoroughly wetted, as also the exposed sides of pots, the paths, woodwork, etc., but at the same time as little water as possible should be allowed to lodge in the pots. Cleaning consists in removing dead or withered leaves, in keeping the foliage clean, for which purpose a small sponge is often useful, in destroying and removing destructive insects, caterpillars, eggs of butterflies and moths (which are frequently deposited on the leaves), etc., in uprooting weeds and stirring up the soil in the pots, which is best done with a pointed stick and should be performed frequently. Training consists in supporting the plants by stakes and ties, and should never be resorted to when a plant is sufficiently vigorous to support itself and naturally assumes a handsome and useful habit. By culture many plants however overgrow themselves and lose in strength what they gain in luxuriance, so that some kind of support becomes necessary. The supports, be it as stakes, rings, or trellis-work, can all be made of the ever-useful bamboo, which even when cut very fine is strong and fairly durable. The supports should as far as possible be concealed by the foliage of the plants. This work should never be entrusted to the mali, who, if he aims at neatness, which however is not at all likely, will endeavour to show off the perfection of his skill in manufacturing supports at the expense of the beauty of the plant, or he will in nine cases out of ten make the supports so coarse and untidy that they cannot fail to be an eyesore. Other operations may occasionally occur in Ferneries, such as pruning, pinching, etc., but they are of such rare occurrence, that they need not be referred to here.

The arrangement and grouping of the plants in the Fernery, and their use for embellishment of drawing-rooms, etc., are works well calculated to demonstrate the individual taste of the operator, and for the correct performance of which no fixed rules can be laid down. As general principles it may however be observed that strict regularity should generally be avoided, though symmetry is desirable; that the individual plants in a group should be sufficientiy distinguishable as to each form a separate object of attraction, without being so conspicuous as to detract the attention from the entire group; that no plants contrasting widely in habit or foliage should be placed in close proximity to each other, that no naturally low-growing plants should be so raised above others of taller growing habit as to assume the appearance of an unnatural habit, and that all pots should be as far as possible concealed.

Regarding the plants generally cultivated in Bombay Ferneries, I shall try in the following sketch to point out those that are most distinctive and most desirable. It has already been remarked that all pillars and posts should be covered with creepers, when possible. The selection for this purpose is fairly varied and great, so it is easy to produce a striking and highly decorative effect. Of all creepers, none is more ornamental, nor more grateful for the shelter offered it by the Fernery, than the beautiful *Vitis* (*Cissus*) *discolor*, which when clothing the pillars from bottom to top with its magnificent velvet-like dark purple elegant leaves, densely blotched with silver-patches and when appending its younger dark red shoots as graceful garlands and lovely festoons between the woodwork of the roof, is a truly magnificent object. A beautiful and striking contrast to this is the feathery climbing *Selaginella lævigata* (sometimes called *S. uncinata* or *S. Willdenowii*) in which the horizontal gracefully drooping fronds vary in colour from the loveliest emerald-green to a beautiful metallic lustrous blue. *Bignonia Roezlii*, with small purple leaves, charmingly netted with rose, violet or white, and forming pretty miniature-garlands, *Passiflora trifasciata*, with olive-green silver-streaked hand-shaped leaves, *Philodendron verrucosum* (*Ph. Carderi*) with warted velvety leaf-stalks and large satiny green heart-shaped leaves, veined with brown, several *Pothos*, *Raphidophoras*, *Scindapsus* and *Dioscoreas* of rarer occurrence, are other highly effective creepers, while the graceful, light green, climbing fern *Lygodium microphyllum*, is most useful for concealing small objects, and its congener *Lygodium scandens*, which many visitors to our hill-stations will often have admired in its perfect wild state, may form an attractive object during the rains, but is unfortunately dormant the remainder of the year. Of recently introduced creepers which have proved valuable additions to our Ferneries, *Schizandra* (*Sphœrostema*) *marmorata* with large silvery leaves, and *Tecoma* (*Campsidium*) *filicifolia*, with small fern-like leaves, may be mentioned. Bombay offers so many advantages for the cultivation of ferns, that this class of plants will in most cases be numerically strongest represented in our Ferneries. Among them the most popular are Maiden-hair ferns (*Adiantums*) of which a great number of kinds are represented. The most common of these is the vigorous and rather tall-growing *Adiantum tenerum*, easily distinguished by its large, yet finely divided, and gracefully arching light green fronds, which in its variety *A. t Farleyense* assume a more drooping habit, and have larger and lighter green, beautifully fringed segments. This variety is generally supposed to be sterile, but at last year's flower-show a well-known fern-cultivator in Bombay, Mr. E. S. Luard, exhibited a fine lot of young plants, unmistakably belonging to this variety, which were raised from spores. A striking contrast to the preceding kinds occurs in the common and easily cultivated *A. trapeziforme* with very broad angular segments, which sometimes attains a height of 3 to 4 feet. Similarly-shaped segments are found in the varieties *A. t. St. Catherinæ*, and *A. t. pentadactylon* which however are distinguished by a lighter green colour and by a very different, less vigorous habit ; in the magnificent *A. peruvianum* with large, gracefully arching fronds, and in the quaint *A. macrophyllum* with almost vertical fronds, and drooping often rosy-tinged segments. *A. digitatum* (*speciosum*), with its large spreading fronds, with rather leathery round-lobed segments is a most distinct kind, but very rare in Bombay. *A. gracillimum* is the acme of perfection as regards gracefulness and minute division, and presents a lovely contrast to the finely-divided *A. excisum multifidum* with wedge-shaped segments, while for compactness of habit, coupled with minutely-divided foliage none can be compared in beauty to the lovely dark green *A. Neo-Guinense,* the almost equally attractive *A. cuneatum mundulum* or the charming almost crested *A. concinnum Flemingii.* Variety in habit and in shades of colour is further presented in the narrow-fronded bright green *A. concinnum*, and in the singularly beautiful greyish-green *A. intermedium.* In *A. formosum* with its dark green, graceful, triangular, finely-divided fronds we come across a different type, which in the highly ornamental, often rosy-tinged tall-growing *A. tetraphyllum gracile,* and in the dwarf-growing *A. diaphanum, A. hispidulum, A. crenatum Wilisianum* and *A. tetraphyllum* assumes differing characters. Our homely Maiden-hair, *A. Capillus Veneris,* is but poorly represented in Bombay, but one of its varieties *A. C. V. Victoriæ* is a very flourishing and handsome dwarf-growing kind, and another beautifully crested, almost moss-like form *A. C. V. Luddemannii* may perhaps still exist in a few Bombay Ferneries. The indigenous *A. caudatum* with light-green, somewhat rust-clad, rooting fronds, and the dark green tender-fronded *A. lunulatum,* which in the rains beautify our walls and the inside of wells, are sufficiently ornamental to deserve a place in every Fernery. A rather curious variety, *A. Buasii,* which has many admirers, though generally presenting an appearance as if flagging for want of water, is too common to be omitted, while a great number of other kinds are so rare, that they cannot in fairness be mentioned as distinctive features of Bombay Ferneries. Among other ferns, commonly met with in Bombay, Gold and Silver-ferns are perhaps the most generally appreciated, such as the exceedingly common *Gymnogramme calomelanos,* with large dark green fronds, silvery-white on their back ; *G. chrysophyllum,* which much resembles the former, but has a more elegant and spreading habit, well calculated to show off the golden-yellow back of the fronds ; *G. Mertensii Dobroydense* with dwarf finely divided, golden-powdered fronds ; *Cheilanthes* *farinosa,* the common Silver-fern of our hillsides; *Asplenium aureum*? with golden fertile fronds, contrasting beautifully with the dark, almost blackish-green sterile fronds; and a few others of rare occurrence. We further observe graceful and finely divided fronds in several *Davallias,* as in the effective *D. bullata* and the beautiful *D. fijiensis plumosa,* in a few *Aspleniums,* as *A. Belangeri* and *A. bulbiferum,* &c. Almost endless variety of habit, form of foliage, and shades of green, occur in the numerous kinds of *Anemia, Aspidium, Nephrodium, Nephrolepis,* of which the charming *N. Duffii* has become a great favourite in Bombay; while few Ferns are so strikingly effective as *N. davallioides furcans,* with its often repeatedly cleft feathered leaves, *Polypodium, Pteris* and *Asplenium* (often subdivided into variously-named forms, such as *Lastræa, Cyrtomium, Pleopeltis, Litobrochia, Pellæa, Gymnopteis, Drynaria,* &c., all referable to one of the above named forms). Conspicuous by their size are the beautiful *Blechnum orientale* and *B. brasilienses,* the only tree-ferns that are successfully cultivated in Bombay; the yet rare, but attractive *Lomariabagiba*; the magnificent indigenous *Marattia fraxinea* which with its large, spreading and repeatedly divided light green fronds, occasionally reaches quite gigantic dimensions, in which respect it is only rivalled by the striking Australian variety of the Bird's-nest fern, *Asplenium Nidus,* of which enormous specimens, in which the simple black-ribbed light green fronds occasionally have more or less forked tips, form a centre of attraction in many Ferneries. The very strong-growing tall and spreading *Pteris podophylla* also deserves to be mentioned for its great dimensions, as well as *Asplenium marginatum* for its very dark green, broad, and long fronds, and *Asplenium esculentum* for its unusually elegant habit. Of Club-mosses, *Selaginellas* and *Lycopodiums,* closely allied to Ferns, a number of beautiful kinds occur in Bombay, of these *Selaginella rubella,* with large spreading triangular fronds changing colour from delicate green to dark coppery-brown, the bright green *S. caulesnsceamoena S. Vogeli* with dwarf flat pale green, often in the centre yellowish-tinged, fronds. *S. Willdenowii* distinguished by its small, neat, dark, dull green, graceful fronds, and the compact erect-growing *S. Martensii,* are the most common. *Lycopodium denticulatum,* with its bright green creeping fronds, seems to alight on every available space in the Fernery, and is, like a few other not clearly identified kinds, most useful for covering rockwork, &c., while the charming metallic blue *L. cæsium* presents a pleasing contrast in colour and is very effective for hanging baskets.

Some of the noblest inhabitants of our Ferneries are the Palms, which also occur in great variety. Many of the same kinds, which have been mentioned as inhabitants of our gardens, find in their young state a congenial home in our Ferneries, and are even there valuable for decorative purposes. Besides these, however, rarer kinds, which have not as yet found their way to the open ground, are occasionally met with. Among these *Chrysalidocarpus lutescens* (*Areca lutescens*) forms a most striking object, by its bright yellow stems, contrasting beautifully with its glossy green, gracefully arched, feathery leaves. *Martinezia caryotæfolia* has the appearance of a compact, miniature fish-tail palm, except that the back of its leaves and the stem are clothed with long black spines. *Thrinax elegans* is a most elegant dwarf palm, with finely divided fan-shaped leaves, *Calamus leptopadix* with pale green, feathery, prickly leaves, *Latania Commersoni*, conspicuous by its dark red large fan-shaped leaves, *Phœnix rupicola* by its graceful habit, *Tubeea spectabilis* and *Cocos Wedelliana* by their feathery very finely-divided leaves, in gracefulness even surpassing the favourite *Cocos plumosa*, are a few of the most ornamental forms, while a pleasing variety may be presented by kinds of *Archontophœnix*, *Bacularia*, *Bactris*, *Calamus*, *Calyptrogyne*, *Chamædorea*, *Dypsis*, *Euterpe*, *Geonoma*, *Hedyscepe*, *Heterospathe*, *Howea*, *Pinanga*, *Rhopalostylis*, etc., still too rare in Bombay. A few kinds of lately-introduced palm-like *Carludovicas* represent the natural order of *Cyclantheraceæ*, while the Screw-palms (*Pandaneæ*) are represented by the effective and handsome *Pandanus utilis*, and the very luxuriant unarmed *P. graminifolius* (?). The vast order of Arum-lilies (*Aroideæ*) is amply represented, chiefly by foliage-plants. Among these none can equal the numerous varieties of *Caladium* in respect to beauty of foliage, exhibiting an endless variety in hue and colour, from satiny green to silvery-white, golden-yellow and shining red, and the most delicate designs in the veined, blotched, dotted or netted leaves. Variations of colour also occur in the beautiful spotted *Homalomenas* (*Curmeria*), in the silvery *Schismatoglottis*, in the exquisitely marked and manifoldly varied *Dieffenbachias*, while it is of secondary merit in the many kinds of *Alocasia*, which are principally effective by the grandeur of their foliage, though some of the kinds, as *Alocasia Lowii*, *A. hybrida*, *A. longiloba*, *A. cuprea*, *A. Thibautiana*, and the allied *Cyrtosperma Johnstonii* and *Xanthosoma violaceum*, present beautiful contrasts of colour. The luxuriant *Schizocasia Portii* is perhaps one of the most striking objects in our Ferneries. The *Anthuriums* are distinguished by the grandeur of their very variable foliage, often by pleasing contrast of colour, as in the beautiful silver veined dark olive-green satiny shining leaves of *A. crystallinum* and a few other kinds, and not unfrequently by beautiful flower wrappers, as in *A. Ferrierense*, with magenta-red, *A. Lindenianum* with pale rose-coloured and *A. ornatum* with pure white wrappers (spathes), the only kinds which have as yet flowered regularly and successfully in Bombay; and finally beautiful scarlet shining berries occasionally succeed the flowers, as in *A. digitatum*. *Spathiphyllums* are equally effective by their large leaves and by the beauty of their snow-white flower-wrappers, the latter character being of secondary merit in the great number of *Philodendrons*, which are principally effective on account of the magnitude and elegant shape of their leaves, in which respect *Ph. Selloum* is perhaps unsurpassed, though less common than the attractive white-veined *Ph. gloriosum*. Several other *Aroideæ* are occasionally met with, but are less common than those mentioned above. *Curculigo recurvata*, a representative of the curious ground-flowering *Hypoxideæ*, is remarkable for its compact habit and folded palm-like leaves. Of the large, almost exclusively tropical order of Gingerworts (*Scitamineæ*) the Plantain tribe is represented by two magnificent *Heliconias*. *H. aureo-striata*, of recent introduction, with beautiful large and broad dark green leaves, brilliantly striped with golden-yellow, and *H. vinosa*, of tall but compact habit, with dark olive-green pointed leaves, suffused with rich vinous purple. Flowers of large size and striking beauty occur in the lately introduced rose-flowered *Kæmpferia* (*Cienkowskia*) *Kirkii*, and in the indigenous white flowered *K. scaposa*, while the smaller pale lilac flowers of *K. rotunda* and *K. Galanga*, appearing when the plants are destitute of their ornamental leaves, are very pleasing. The highly eulogised *Burbidgeanitida* has not as yet flowered in Bombay. Though beautiful or quaint flowers occasionally are met with in the many varieties of *Calathea* and *Maranta*, these are principally conspicuous by their magnificent leaves, presenting an almost endless variety, in shape, size and colour. The tall-growing broad-leaved *Calathea princeps* with purplish and yellowish marked leaves, the charming *Calathea zebrina* with drooping satiny green leaves striped with velvety black, the neat *C. regalis* with small leaves, densely veined with bright red or white, the panther-spotted *C. pardina*, the compact and elegant *C. Leitzii*, and the highly effective creamy-white variegated *Maranat arundinacae fol. pol. var.* are among the best of the numerous varieties found in Bombay Ferneries. The Lily order (*Liliaceæ*), which is so rich in beautifully flowering plants, is curiously enough in our Ferneries only represented by plants conspicuous by their foliage. Such are the *Cordylines* and *Dracænas*, which by the brilliant colour of their leaves, varying in all shades of green, yellow, red, white, and almost black, coupled with a graceful habit, are well calculated to range among the most effective ornamental plants. It is needless here to enumerate the numerous varieties and kinds represented in Bombay, only one of which, *Dracæna surculosa maculata*, is of so entirely a different type, that it is rarely recognised as a *Dracæna*, it is distinguished by its compact shrubby habit, its shining pale blotched small leaves, and by drooping tassels (umbels) of small white flowers, often succeeded by bright scarlet berries. *Anthericum* (*Phlangium variegatum*), with tufted, linear, creamy white striped leaves, is another effective foliage plant, belonging to the same order, as does also the recently introduced, still rare and charming *Asparagus plumosus*, which in fineness even surpasses the most beautiful fern. Plants of the order *Amaryllideaæ*, are, or should at least not as a rule be, permanent inhabitants of the Fernery, but they are, when in flower, not only most beautiful ornaments, but they also generally benefit greatly by their temporary stay there, and subsequent removal to a dry and sunny position, which treatment in most instances results in a successful development of flowers. The brilliant *Hippeastrum* (*Amaryllis*), whose scarlet, crimson, orange, or occasionally pure white or rose-coloured, frequently striped flowers, are beautifully set-off by being surrounded by the graceful fronds of ferns, many kinds of *Crinum*, such as the white flowered *C. bracteatum*, the rosy tinged *C. longiflorum*, *C. scabrum* and *C. amabile*, the pure white flowered *Pancratium zeylanicum*, *Hymenocallis rotata* and *H. speciosa*, the broad-leaved compact flowering *Eurycles Australasica* and *E. Cunninghamii* are, as well as the various kinds of *Eucharis*, all handsome flowering plants, well calculated to break the monotony of a collection of foliage plants. The small order *Hamadoraceæ* is represented by a beautiful Japanese plant with tufted linear leaves, striped and flaked with creamy white, and sometimes producing beautiful blue berries, *Ophiopogon Taburan fol. var.* The pine-apple order (*Bromeliaceæ*), which contains so many interesting and beautiful flowering plants, is far too scantily represented. The peculiar habit of these plants is always attractive, and many of them possess when in flower a most glorious beauty. *Æchmea discolor* and *A. fulgens*, both with brilliant scarlet flower-spikes, and the magnificent *Æ. paniculigera*, with lovely rose coloured shield leaves (bracts) and purple flowers, are occasionally met with. The incomparable *Bilbergia zebrina*, with its quaint erect blotched leaves, and its large drooping flower-spike, wrapped in delicately pink velvety shield-leaves, which add a peculiar charm to the greenish flowers, and the white, mealy flower stalks and cups, is of exquisite beauty. *B. Moreli*, *B. Saundersii* (chlorosticta) are less conspicuous, but still valuable. The dwarf-growing *Cryptanthus acaulis* is interesting and attractive by its hierogryphically marked leaves, while *Karatas spectabilis* is another beautiful plant, with bright scarlet crowded spikes of blood-red, white and bluish-violet flowers, and is easily recognised, when out of flower, by the blood red blotch on the tip of its leaves.

Orchids are unfortunately not easy to cultivate in Bombay, and several attempts to grow the splendid *Cattleyas*, *Odontoglossums*, *Lœlias*, *Lycastes*, *Masdevallias*, *Maxillarias*, *Oncidiums*, *Stanhopeas*, etc., which form the cream of Orchid collections at home, have hitherto been unsuccessful, and it is even very rare to see other less-conspicuous and almost indigenous forms of this magnificent order flowering regularly and profusely. Of the *Aerides*, several grow at our hill-stations, as the beautiful *Ae. crispum* with large drooping clusters of delicate rose-coloured, sweet-scented flowers; the smaller but darker-coloured *Ae. maculosum*, and the beautiful strongly-scented *Ae. odoratum*; but none of them are very regularly flowering when established in our Ferneries. Of the African *Angraecums*, the beautiful large white-flowered *A. sesquipedale* has flowered well in a well-known orchid-collection in Bombay (Mr. M. C. Turner's), *Bletia hyacinthina* and *B. verecunda*, ground-orchids with handsome dark crimson flowers, deserve some attention as they seem to flower regularly. The *Calanthes*, also ground-orchids, are well represented by the pretty white-flowered *C. veratrifolia* which is quite hardy, even in the open ground, and flowers profusely, and by the lovely varieties of the rose and white-flowered, exceedingly beautiful *C. Veitchii* and *C. vestita* which also flower well. A few tree-growing *Cymbidiums* with their long drooping sprays of brownish-yellow flowers are among the freest flowering orchids of our Ferneries. The highly interesting and often exceedingly beautiful *Cypripediums* or Lady's slippers are represented by a few kinds, but are very rarely seen in flower. The *Dendrobiums* undoubtedly contain the most attractive kinds of our orchids and occur in great variety. Among the best and most regularly flowering, *Dendrobium aureum* is very conspicuous by its bright golden-yellow flowers, while *D. barbatulum*, which is common at our hill-stations, is attractive by its graceful sprays of bell-shaped pure white or sometimes flesh-coloured small flowers, and the white-flowered *D. cretaceum* is peculiar by its long drooping whip-like stems, often entirely covered with rather large flowers. *D. Dalhousianum* with large pale yellow flowers, blotched with purple, is of striking beauty, and belongs with splendid purple-flowered *D. nobile* the charming, very large flowered pure white, *D. formosum* and *D. Picrardi* with white, yellow and bluish-tinged large flowers on long drooping stems to the best representatives of this form (genus), but unfortunately they are but rarely seen in flower in Bombay except when freshly imported. The rather common *D. secundum* with tooth-brush-like rose-coloured flower spikes is more peculiar than beautiful. The *Epidendrums* are represented by one kind only, *E. elongatum*, with small rose-coloured flowers, and of very easy cultivation. The beautiful *Habenaria* (*Platanthera*) *Susannæ*, from our hills, with large fringed, long spurred, pure white flowers, in a tall spike, would prove a valuable addition to the collections at home, where to my knowledge at least it is hitherto unknown, while several other kinds of *Habenaria Eulophia* and other interesting indigenous ground orchids flowering in the rains, might prove valuable additions in our Ferneries. Of all ground-orchids cultivated in Bombay, none can however equal the beautiful *Phajus Wallichii* (*Bletia Tankervillæ*), whose tall, often numerous spikes of very large white, purple, brown, and yellow flowers often continue in flower for 4-6 weeks, and are freely and regularly produced. *Phajus albus* (*Thunia alba*) is a handsome tree orchid, with large delicate white and lilac flowers, appearing during the rains. The charmingly beautiful *Phalænopsis,* of which *Ph. grandiflora* with lovely pure white flowers is the most common, and the pretty *Saccolabium giganteum* with dense clusters of white and rose-coloured flowers, almost never fail to flower, while the not uncommon *Vanda Roxburghi* and *Vanda teres* very rarely flower in Bombay.

All the plants hitherto mentioned belong to flowerless plants and to one-seed-leaved plants, and form the vast majority of the plants represented in our Ferneries. Two-seed-leaved plants are as a whole but very poorly represented. One particular order however, that of *Begonias,* is very fully represented by both flowering and ornamental leaved kinds. Of the many handsome flowering kinds, *Begonia platanifolia* with large white flowers and beautifully shaded leaves, the delicate rose-flowered *B. hydrocotylæfolia,* the creamy white flowered *B. manicata,* the bronze-leaved pink-flowered *B. erecta multiflora*, *B. dipetala* with its silver-spotted leaves and large pink flowers, *B. maculata*(*argyrostigma*) with white-dotted leaves and pink flowers, and *B. semperflorens Saundersii* with bright coral red flowers, are a few of the most common. The list of ornamental leaved kinds is naturally headed by the great number of varieties sprung from *B. Rex,* to which the pretty *B. Richardsiana Diadema* with silver-spotted lobed leaves, the broad-leaved and beautifully marked *B. rubella,* the small velvety silver blotched *B. imperialis,* the metallic hued *B. emtallica,* the satin leaved silver-dotted *B. Olbia*, the finely netted *B. sceptra,* the neat and compact habited white-dotted *B. albo-picta,* are valuable additions of recent introduction. Slightly resembling *Begonias*, though belonging to a very different order, *Urticaceæ* or the Nettle-order, the *Pellionias* with beautifully variegated leaves are charming plants for hanging baskets. The beautifully flaked and many coloured *Hoffmannias* of the order *Rubiaceæ* are general favourites, while the order *Gesneraceæ* is represented by such beautiful plants as *Episcia* (*Centrosolenia*) *bullata* with dark purple-bronze warted leaves, the bright scarlet flowered velvety-leaved *Episcia* (*Cyrtodeira*) *fulgida*, several *Gesneras* and *Sinningias* (*Gloxinia*), the latter of which are however but rarely successfully grown in Bombay. The order *Melastomaceæ* has a beautiful representative in the singularly handsome *Miconia* (*Cyanophyllum*) *magnifica*, whose dark olive-green, satiny light arch-veined leaves almost baffle description. The *Peperomias* of the Pepper-order (*Piperaceæ*) with silvery or netted leaves, and the ornamental-leaved *Aphelandras*, *Fittonias* and *Gymnostachiums* of *Acanthaceæ*, conclude the choice of plants generally found in Bombay Ferneries.

In conclusion, I only beg to remark, that as in our gardens so in our Ferneries, there is still room for great improvements and valuable additions, which to a very great extent depend upon the individual efforts of the residents of Bombay, to whom I hope the contents of this paper may prove of some service in this respect.

THE BUTTERFLIES OF THE CENTRAL PROVINCES.

By J. A. B.

Part IV.

(*Continued from Volume V., page* 286.)

FAMILY 3, LYCÆNIDÆ.

We now come to the family of the "blues," "coppers," and "hair-streaks," which, as Mr. Aitken has remarked, can well be divided off into the "feeble" and the "robust folk." The "feeble folk flitting mostly near the ground, or resting on low bushes with their wings slightly opened;" the others "robust in body and brilliant in colour, swift and wary, given to basking on high trees."*

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* *Journal of the Bombay Natural History Society*, Vol. I., p. 215.

The order in which Mr. de Nicéville has placed these butterflies gives the "feeble" ones precedence. Most of the "blues" are of small size; some are, as far as is yet known, the smallest of the whole butterfly tribe. None in this country exceed a breadth of more than 3·10 inches, and this is only reached in *Liphyra brassolis*, which, in appearance at any rate, hardly seems to be either a "blue," a "copper," or a "hair-streak," though it is one nevertheless. This family has many interesting features about it, the chief, I think, being the way in which many of their larvæ are attended by ants. Some very interesting instances are given in Mr. de Nicéville's valuable work. It is also stated in Mr. de Nicéville's work (page 56, Vol. III., *Butterflies of India, Burmah and Ceylon*) that a carnivorous larva has been discovered in Ceylon, though this requires confirmation. It would be most interesting to know if this statement has been since verified. Very many of the butterflies of this family are adorned with lobes and tails varying in number and length. Of the tails some look just as if they were mere prolongations of the hair-like fringe which border the wings, while others are as long or longer than the depth of the hindwing to which they are always attached, and are curled and feathered in various ways. All the butterflies of this family have the habit of moving their hindwings one over the other when settled, something like the motion gone through with one's hands when making up a pellet in the palms. When this is done the opposite tails and lobes come in contact and are agitated. It is probably done to show off their ornaments, just as the peacock spreads its tail and rattles its feathers. Very many have the hindwings decorated with eyes, and the motion is evidently gone through with a view to display all the ornaments to the greatest advantage. Numbers of these little butterflies, especially the males, are fond of alighting on the ground where it is damp and there sucking up the moisture. Just outside the bath-room, which is always more or less moist, is a favorite spot for many varieties, and they share this predeliction with many of the family of the "whites" and some of the "swallow-tails," as will be noticed hereafter.

53. Chilades laius, Cramer (672). This butterfly is very common almost everywhere, and is a very tiny insect. It flutters about the grass and low bushes, but is a pretty little creature nevertheless.

The colour of the male is a purplish-blue with a blackish border to the wings; the underside is silvery-grey, with various splashes and dots. The female is brownish. This butterfly has two forms, the one which is procurable in the dry-season having a large dark blotch on the underside of the hindwing, partially covering it and obscuring the markings. The larva looks like a little green grub, especially (as is generally the case when disturbed) if the head is not seen. This latter is black, and can be completely hidden beneath the second segment of the body. When feeding the little black head is protruded. On the eleventh segment is placed an organ from which exudes a clear liquid of which the attendant ants are very fond. The larva feeds on the leaves of the lime or on the pomolo tree, and is always attended by one or more ants which run over its body and keep on touching it with their antennæ. The ant which I found attending it appears to be the common one, which curls its body up over its back when disturbed, and lives in trees building paper nests.

54. *Chilades trochilus*, Freyer (673). This is a very tiny little butterfly, the smallest (except perhaps *Zizera gaika*) in India. Both sexes are very much alike, brown above and a little lighter underneath. It is marked below with dots and splashes; but the distinguishing feature is a row of brilliant metallic spots or eyes bordered with yellow on the hindwing. These spots can be seen faintly on the upperside. It is common everywhere and affects the ground, fluttering low about the grass and weeds.

55. *Cyaniris puspa*, Horsfield (681). I have taken this at Pachmarhi and in the Sambalpur District. The distinguishing feature is the white centre or disc of the forewing, which is bordered with brownish in the female and blue in the male, the hindwing having also a dash of white. It does not seem to be very common about the Central Provinces.

56. *Zizera maha*, Kollar (694). This is a common little "blue." It has a silvery or greyish sheen upon the wings which have a black border. The female is of a brownish-purple colour. I never came across it in Chhattisgarh, though at Pachmarhi and Jabalpur it is very common. All the butterflies of this genus fly low.

57. *Zizera gaika*, Trimen (702). This shares with *C. trochilus*,

already mentioned, the distinction of being the smallest butterfly in India. It looks like a miniature of the last-named species, but the dark border to the wings is not so well defined.

58. *Zizera lysimon*, Hübner (699).

59. *Zizera otis*, Fabricius (703). These are both more or less like the others mentioned of the same genus, are smaller than *Z. maha* and larger than *Z. gaika*.

60. *Everes argiades*, Pallas (716). This is a little, bright blue butterfly with silvery underside; near the tail, on the underside of the hindwing, there are some orange markings, below which are a couple of black spots. It is fond of settling on the ground and sucking up the moisture in damp spots. It is found almost all over the world.

61. *Nacaduba ardates*, Moore (730). This is a purplish-coloured insect with the underside brownish, marked with fine white waving lines. It is peculiar in having a tailed as well as a tailless form. Just above the tail, when present, on the underside, there is a small black spot marked with greenish scales.

62. *Jamides bochus*, Cramer (733). This is a most lovely little creature, the most brilliant, I think, of all the "blues," and only approached in the depth of its brilliantly metallic lustre by *Tajuria longinus*, though the blue in the latter has a greener tinge, whereas in *J. bochus* it is of a deep blue. It is wonderful to see this butterfly flashing among the bushes and trees, looking like a sparkling gem as it darts hither and thither. When it rests it disappears; but as soon as it rises the flash of colour from the wings reveals its presence, and the beholder is struck with admiration.

63. *Lampides elpis*, Godart (734). The three genera of *Nacaduba, Jamides* and *Lampides* are very close to one another, the colours on the upperside of the wings being the chief difference between them. The markings on the underside are very similar, and are disposed in the same manner in each species of the three genera. In *Jamides* the blue on the upperside is very deep; in *Lampides* it is very pale, almost milk-white in some species, while in *Nacaduba* the shade of colour appears to be something between the other two genera.

L. elpis is a beautiful insect, the colour of the upperside being a pale though shining blue; the underside is similar to *J. bochus*, but paler; the markings are disposed in very much the same manner.

64. *Lampides ælianus*, Fabricius (738). This is a delicate and fragile butterfly, and in flight is more feeble than the two preceding. Its colour is a very pale blue, almost milk-white. The underside is pale brown with wavy white lines, and sometimes some of these lines enclose a darker ground and form a figure resembling the letter Y, this latter being the form which is found in the dry cold season. It is fond of shady glades and woods.

65. *Catochrysops strabo*, Fabricius (743). This is a delicate silvery-coloured insect, the blue of the wing being pale and with a satin-like sheen. It is fond of sucking up moisture from the ground.

66. *Catochrysops cnejus*, Fabricius (745). This very much resembles the last, but can be distinguished from it by the underside being of a browner tinge.

67. *Catochrysops pandava*, Horsfield (750). Very like the two former, but of a darker blue altogether; the underside too is distinctly darker.

68. *Tarucus theophrastus*, Fabricius (752). A deep blue, almost purple butterfly, with a small black mark about the middle of the forewing on the upperside. The underside is white with black spots and splashes, and there are some metallic spots near the outer margin of the hindwing. The female is almost white above, with a little blue at the base of the wings.

69. *Tarucus plinius*, Fabricius (758). Not much like the preceding. The underside is marked with larger splashes than the foregoing, the splashes being of a brownish colour. It is a pugnacious little creature, and in common with many other "blues" when engaged in aërial combats ascends high into the air.

70. *Castalius rosimon*, Fabricius (759). A black and white butterfly something like the female of *Tarucus theophrastus*, which it greatly resembles when on the wing. The spots on the underside seem to vary in size according to the season, being darker and running into one another in the specimens appearing during the rains.

71. *Castalius decidea*, Hewitson (766). Very much like the preceding, except that it has a brownish tint on the underside of the wings.

72. *Polyommatus bæticus*, Linnæus (767). This is what is

called the "long-tailed blue" in England, where it is very rare, though common enough on the continent. The upperside of the wings in the male appear to be frosted from the long scales with which the other scales are overlaid. It is very common, and a swift flyer. The underside is brownish, with some narrow pale bars and one conspicuous bar across the disc. It is found almost all over the world, America being about the only portion it does not affect.

73. *Amblypodia naradoides*, Moore (772). We now come to the "robust folk" spoken of at the beginning of the "blues," the habits of which are quite different to all the others hitherto mentioned. It is extremely difficult to follow the flight of these robust creatures: they seem to go past you with a "whirr," and as the Paddy said of the snipe, "Before you can see them, they are out of sight, bedad." *A. naradoides* is a purplish insect on the upperside, but the underside is marked very like a dead leaf, and is in miniature like the underside of the butterflies of the genus *Kallima*. The shape of the wings when folded is also leaf-like, and when seated on the ground it is difficult to distinguish the little creature from the dead leaves with which it is surrounded. I met with this species in Chhatisgarh and nowhere else.

74. *Iraota mæcenas*, Fabricius (776). I have only three ragged males of this species, all taken by myself at Pachmarhi. I have not met with it elsewhere in the Central Provinces. From the appearance of the fragmentary specimens I possess, I should imagine this to be a most lovely little insect, as the blue on the wing is so vivid. The underside is reddish-brown, adorned with silvery spots and marks, quite different from those of any other "blue" I know of.

75. *Arhopala amantes*, Hewitson (791). This is a most glorious creature. The male is of a brilliant, intense blue colour, and the female is even lovelier, as the blue is bordered with deep black. It is a large insect as "blues" go, measuring something more than two inches across the expanded wings. It flies very fast, and the only way to catch it is to watch where it alights, and then, either with a vigorous sweep or by dropping the net over it, capture it. One year it appeared in numbers in company with the next described species on a *falsa* tree (*Grewia asiatica*) in my garden at

Raipur immediately after the first heavy fall of rain in June. It is common at Sambalpur and is not uncommon at Jabalpur.

76. *Arhopala atrax*, Hewitson (801). This is a miniature of the above; but the wings are of a much duller colour and purple rather than blue in tone. It is very common at Pachmarhi, and a smart blow given with a stick on almost any shrub on the plateau will set scores of them flying. It has the same habit as *A. amantes* of hiding away in the leaves of trees and shrubs.

77. *Curetis thetis*, Fabricius (850).

78. *Curetis bulis*, Doubleday and Hewitson (858). The genus *Curetis* consists of butterflies of a peculiar and striking coloration. The males are of a brilliant coppery-red above and silvery-white underneath, while the females are either white or ochreous above (in a Japanese form dull bluish) and silvery-white underneath. In both sexes the upperside has a black border varying in width, so that in some specimens but little of the ground-colour is seen, while in others as little of the border is apparent. The effect of the rich red and silvery-white while in the act of flight is charming and not a little surprising. In *C. thetis* the black border is much narrower than in *C. bulis*, and does not extend along the inner margin of the fore-wing. In *C. bulis* (to which *C. angulata* (856) and *C. dentata* (857) are very nearly related, if they are not actually the same species) the black border extends along the inner margin. Both forms are obtainable at Pachmarhi and also at Sambalpur. The transformations of this genus are very curious, and the account given of them, in "The Butterflies of India," by Mr. de Nicéville, will well repay perusal.

79. *Zesius chysomallus*, Hübner (890). I have only succeeded in procuring a few specimens of this butterfly, all at Sambalpur. The female is much larger than the male and in appearance is totally unlike, it being of a bluish colour, while the male is of a bright copper colour, and not only this, but the female has three tails to each hindwing, while the male has but two. I always found the females flying near the ground where the ground was marshy, and near tanks, while the male darted about among the leaves of trees like most others of the "robust folk;" the female in this respect resembled the "feeble folk."

80. Aphnæus vulcanus, Fabricius (903). This is a small butterfly of a bluish-black colour above, the male blue-glossed, with several bars of orange on the forewing. Underneath, the wings have several reddish bands across them, each band with an inner streak of bright silver. The underside is more beautiful than the upper! The butterflies of this genus fly very fast; but they seem to haunt one particular chosen spot, sporting about a space of some twenty or thirty square yards, and resting on a leaf or the topmost twig of some shrub every now and then. From three to half past four or perhaps later in the afternoon seems to be the time they choose for this sort of play. Sometimes it is one alone who frequents a certain spot, at other times there are several engaged in this sport, and when they meet in their gyrations they ascend rapidly into the air for some distance, most likely in furious combat, and then descending, go on with the same rapid movements as before and that have thus been interrupted. They are fond of settling on the flowers of the common marigold, *Tagetes erecta*, when that plant puts forth its brilliant attire. This last habit is shared with many other *Lycænidæ.*

81. Aphnæus trifurcata, Moore (915). This is very like the last except that the colour on the forewing is bluer, and it bears only one small orange mark. The silver streaks underneath are bordered with black. The habits of this butterfly are the same as those of *A. vulcanus.*

82. Tajuria longinus, Fabricius (931). The male of this species is a most lovely little insect, the upperside being a brilliant greenish-blue with a deep black border. The underside is silvery-grey, with a few small narrow curved black marks disposed in a sort of band across the wings. The female is pale blue with a dark border to the wings on the upperside; the underside is the same as in the male. It is a forest-loving insect and settles on the leaves of trees.

83. Tajuria jehana, Moore (932). This very closely resembles, in both sexes, the female of the last-named butterfly.

84. Loxura atymnus, Cramer (977). This is a peculiarly-shaped butterfly, as the hindwing is lengthened out into a long tail; the forewing is sharply pointed. The colour of those captured by me is a pale orange with a black border to the forewing, narrower in the hindwing. It has a weak flight, and is unmistakable on the wing from its peculiar shape and colour. It has to be handled very gently, as its tails are so easily broken. It appears to frequent the outskirts of forests, among bushes and clumps of bamboos. I have found it nowhere else.

85. *Rapala schistacea*, Moore (995). I only caught one male specimen of this butterfly in Kalahandi. The colour is a dark blue with a beautiful gloss in some lights.

86. *Rapala melampus*, Cramer (1006). This is a brilliant little butterfly; the colour of the forewing being of a vivid red, bordered with black. It is very common in the Central Provinces, and is found almost everywhere. It seems to be a hardy and bold little creature, for I have frequently noticed it in the hot weather flying about and settling down near the "khas-khas tattie" for the sake of the water which drains away from that very necessary adjunct to one's comfort in this part of India during the hot season.

87. *Virachola isocrates*, Fabricius (1012). This is a fairly large "blue," the colour being a greyish-blue with a small patch or spot of orange on the forewing, which spot is more conspicuous in the female. The caterpillar of this species is remarkable, as it feeds inside various kinds of fruit with a hard rind or hard seeds, such as the guava (*Psidium guava*) and pomegranate (*Punica granatum*). It has the instinct to attach the fruit to the tree by a slight but strong web, so that, should the fruit get detached, it cannot fall. These remarkable features in its life-history are well and fully described in the third volume of "The Butterflies of India, Burmah and Ceylon," by Mr. de Nicéville, pp. 478-480. I can testify to its swiftness of flight and difficulty of capture as deposed to by Mr. Aitken. I have never reared it, but hope to do so this rains, for I have captured it on two or three occasions in the station in which I am now living, and as there are plenty of guava and pomegranate trees about, a patient search should reveal some larvæ.

ON ABNORMAL HORNS OF THE INDIAN ANTELOPE, WITH SOME REMARKS ON THEIR PROBABLE CAUSES.

By A. W. Morris, F.Z.S.

(*With a plate.*)

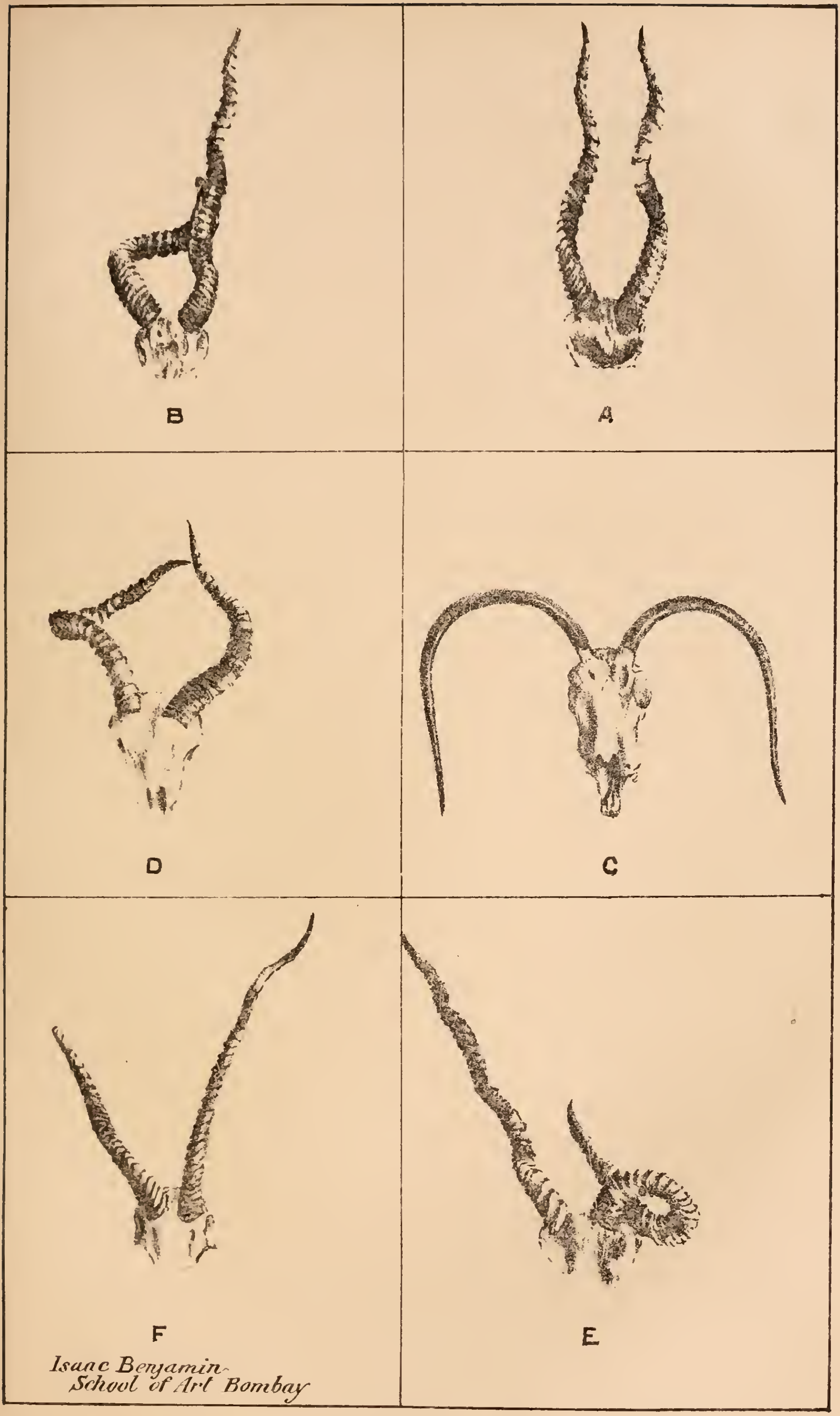
Perhaps no group of animals has puzzled and perplexed the systematic zoologist more than the Ruminantia, and the splitting up of the tribe into subordinate types has proved no easy task even to the best classifiers.

The horns have been relied upon almost exclusively by some writers on the subject as affording the best means of separating the different families, while others, again, have based their arrangement on various points of structure as supplying important characters for the division.

Although the ox and deer tribes may be said to have taxed the ability of classifiers thus severely, the antelopes, however, with a few exceptions, do not appear to have given the same amount of trouble in their arrangement, the *shape* of the horns having been taken as supplying important and well-marked character for their separation from the rest of the Ungulata of which they form a sub-tribe.

Resembling the deer in many respects, they are yet abundantly distinct from these animals, and may readily be distinguished from them by the character of the horns, which are hollow at the base, set on solid bony cores like those of the ox and permanently retained, whereas among the deer they are periodically shed and renewed, a stag in "velvet" being a familiar example of this process. Their shape is usually "lyrate" or conical and set above the eyebrows, which is one of the important distinguishing characters, and *never* misshapen or distorted, as is so often the case with many of the other members of the family, so that any obvious departure from the normal growth must be considered as abnormal, and as such deserves to be noted and recorded.

From being permanent and not deciduous, it stands to reason that any particular direction they may assume cannot at a subsequent period be modified or altered to the usual shape, so that as they are influenced at the start, so must they remain for all time. The cause or set of causes, however, that operates in this way and gives rise to



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ABNORMAL HORNS OF THE INDIAN ANTELOPE
(ANTELOPE BEZOARTICA)

these abnormalities and other monstrosities is, as yet, not very apparent, and on no condition or relation, so far as we know, do they appear to be dependent, though certain theories have been advanced to account for them which require further confirmation for final acceptance. At the present moment it is the generally received opinion that bodily accidents are mainly instrumental in inducing abnormal growths, and that injury to the testis in particular is the primary cause of producing these aberrant types; but nowhere, so far as I know, is there evidence to prove *beyond doubt* that this is so. Blyth, as noticed by Jerdon, *suggested* that the example of an antelope's deformed horn as then known was probably the result of an injury to the animal's testis on that side; but the statement is not put forward as authoritative, but only suppositional, so that, in the absence of subsequent confirmation, much weight cannot be attached to it, notwithstanding the observation made at page 249 of the *Mammals of India*, that "there is a wonderful sympathy between the generative organs and the growth of the horns," which remark I do not interpret as applying to *all* ruminants for obvious reasons. In dealing with the question, perhaps it is just as well to remember that the horns of deer and antelopes are formed of quite different material—the antlers of the Cervidæ partaking more of an osseous nature, while those of the Bovidæ are of another substance which is capable of easy deflection; so that trivial causes that may have no effect in the one case may operate powerfully in moulding aberrant types in the other. I very much doubt if an antler could be made to describe a circle; but with horn this is easily done, and it is doubtless pretty generally known that the Kaffirs and Zulus are in the habit of training the horns of their cattle by different methods into various and fantastic shapes to suit their tastes, so susceptible are they to manipulation; and though these are artificial ways of producing desired results, something of the kind may come into play in nature when intent on accomplishing some of her many freaks.

In some cases, perhaps, *health* has a great deal to do with the production of abnormal horns, and we all know what an important factor it is in the proper development of man, as well as of the lower animals; but on this point, unfortunately, no record seems to have been left for subsequent inquiries, so that we are utterly in the dark when moving on this conjecture. I am strongly inclined to suspect, however, that *severe injuries to the skull*, inflicted either during battle or through some accident, are the main causes that produce abnormalities, the horn on the injured side being thrown out of its natural course by the concussion or damage sustained. In an interesting article "On Abnormalities in the Horns of Ruminants" at page 123, Vol. I. of the Society's publication, Mr. Sterndale suggests that possibly the osseous core has something to do with deflecting horns from their natural direction; but if this be the case, the question would naturally suggest itself—This is an abnormal condition also: by what means did it arise, and how would it affect the shape of horns, which usually present deformities away from the region of the osseous prominence? This is, I believe, an important consideration, if we are inclined to accept the suggestion, though in certain cases, as we shall see further on, the core may, with some show of reason, be supposed to give the direction. Theories, however, may be multiplied as to the possible cause of these deformities, but till such time as closer observation and research are brought to bear on the question, no satisfactory or conclusive results can be arrived at to account for them.

In the accompanying plate some very abnormal types of horn are figured for the purpose of illustrating the various and peculiar shapes some of them have assumed, which, I believe, are of more frequent occurrence in nature than we either imagine or suppose from our very limited knowledge of their existence, and which I shall now proceed to notice.

As is well known, the horns of the Indian antelope (*A. bezoartica*) are graceful objects to look at, and compare very favourably with those of the other members of the group in beauty and symmetry of shape. They are large and long for the size of the animal, and spiral in form, diverging at the tips, and marked nearly their entire length with strongly developed rings. They vary greatly in divergence and degree of spiral twist however, and cases where they have grown almost parallel instead of the usual V shape are not unknown. Fig. A in the accompanying illustration represents a pair of very symmeterical and well-formed horns of this type, grown almost parallel with each other. In cases of this nature it will not be difficult to suppose, as suggested by Mr. Sterndale, that the bony core may be mainly instrumental in giving the upright direction here observed. Fig. B is an example of a horn which, in addition to being malformed, has also been broken off beyond its middle, what there is of it having grown outwards and then inwards behind the other one. We do not know, of course, at what particular period of its growth the fracture occurred or how it happened, though there is ample reason for supposing that it must have been during an early period of development, and the theory of injury may here come in with some force, as the damage could have but resulted from something of this nature, either in battle or through some accident.

At Fig. C we have a very curious and unnatural example in this species of animal, the females of which, like those of most of the Cervidæ and Antelopinæ, are entirely hornless; but in this case the horns are said to be those of a doe antelope which have grown outwards and downwards in a most unusual manner. They are reported to be very thin, only an inch and a quarter in circumference at the base, though 16¼ inches in length on the outside curve, and perfectly smooth, with neither rings nor flexures on their surface. All known examples of these horns seem to agree in being perfectly thin, though varying in length, and at page 46, Vol. II., of the Society's Journal, Mr. Sterndale has figured and described a pair of very similar horns in which the rings, however, were very apparent. These monstrosities are certainly of rare occurrence, but few instances of the kind being known to us, Jerdon mentioning three cases only as being on record in which the horns were " thin and much curved, ' gyring round like those of *Ovis ammon.*' " Hermaphroditism is undoubtedly the promoting cause of these abnormalities.

Fig. D represents the head of a fine buck at present in the Mysore Government Gardens at Bangalore. In this case the left horn bulges outwards almost at its base, as with the sheep, goats and some species of African antelope, sweeps downwards at about half its length, and then twists back upwards and inwards, meeting its fellow-horn near the tip. As this is a living animal, perhaps it is just as well to remark here that it appears a perfect and well-developed specimen of its kind in other respects, with no indication whatever of disease or other anæmic conditions. Closer investigation, however, may possibly reveal certain signs which would help us, in some measure, to account for these various eccentric growths.

Fig. E has already been illustrated and noticed at page 123, Vol. I. of the Society's publication by Mr. Sterndale, and affords a curious and interesting example of the many malformations these horns are subject to. Here we have the right horn perfectly natural, whereas the left one sports in an amazing manner, curving outwards, backwards, and finally upwards behind the right ear, looking very much as if some strain during growth were accountable for the deforming.

At Fig. F we have another type of abnormal growth, and one which, so far as we know, is rather uncommon and peculiar. In this case the horns, one of which has been broken, are exceedingly flat, and the rings, which are much closer than usual, appear on their front surface only, the left horn further having one flexure at the base, while the other twists once only at the tip. In this instance also some severe injury to the skull may easily account for the deformity, and eventually perhaps some such cause will be found to give rise to these malformations, and it is much to be desired that as full particulars as possible may be recorded by those that have the opportunity when cases such as these fall under their observation, as then and then only can we hope to arrive at a satisfactory solution of this difficult question.

In concluding the subject I must not forget to mention that it is mainly through the kindness of Mr. Phipson, who has also furnished me with some rough notes on the different sketches, that I have been enabled to bring together Figs. A, B, C, E, and F, which are from specimens in the Society's collection, while D represents the head of a fine buck in the Government Gardens at Bangalore, on seeing which I was at first induced to draw up the present imperfect paper.

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BOMBAY GRASSES.

By Dr. J. C. Lisboa, F.L.S.

PART IV.

(*Continued from p. 349, Vol. V.*)

Dimeria, *R. Brown.*

D. Hohenacheri, Hockst. Hohenack. Pl. Ind. Or.; *Psilostachys, Hohenacheri*, Steud, Syn. Pl. Glum. I. 413. In North Kanara, collected by Mr. Talbot. Also grows in Mangalore.

D. Ornithopoda, Trin. Fundam ; *Andropogon filiformis*, Roxb. *Flor. Ind.* I. 256.

Var. *D. tenera*, Trin.

At Mahableshwar and Lanowlee. In the latter place it is not uncommon.

D. fuscescens, Trin. Mem. Ac. Petersb. Culm slender, 14-16 inches long, glabrous. Sheaths with a few hairs towards the junction with the laminæ, or none. Nodes glabrous. Ligula very small, truncate, membranous. Leaves linear, acuminate, 2-3 inches long by 2 lines, rather rigid, covered with numerous hairs. Racemes terminal, secund, 2 or rarely 3, 2-2¼ inches long, one sessile, and the other on a peduncle 3 lines long, enclosed in, or emerged from, the last sheath; one raceme is often branched. Rachis almost glabrous, convex on one side, and notched or depressed on the other.

Pedicels, distant, separated from each other by 1 line, glabrous; very small, nearly ¾ line long. Spikelets of light yellowish-brown colour 2-2¼ line long, inserted singly and alternately on the notches.

1st or outer glume 2 line long, narrow, linear acute with hair or ciliate on the margins.

2nd glume, broader, a little longer (about 2½ line), acute with ciliated margins.

3rd, transparent, smaller (about 1 line), narrower and thinner than the last two glumes; no hairs.

4th, nearly the size of the third, 2-dentate with a twisted and bent awn, arising from the top between the teeth. Stamens 2.

Grows in Lanowlee, in the fields, in front of the bungalows of the G. I. P. Railway employés. Also in Bengal, Kassia, and Nepal.

D. gracilis, Nees, Steud. Syn. Pl. Glum. 413. *D. laxiuscula,* Thew. Trimen's Journal of Bot., 1885, p. 272. This is not common like the latter species, is found in our ghâts. Both grow among other grasses, specially amongst *Arthraxon echinatus,* and have a peculiar withered look in consequence of their light brown or yellowish-white inflorescence. Cattle do not seem to touch it.

IMPERATA, *Cyrill.*

Imperata arundinacea, Cyrill; *Saccharum cylindricum,* Roxb. *Fl. Ind.*

Ver. *Dhub.* In moist places all over our Presidency not common, Widely dispersed over Northern India, both in the plains and on the hills, more especially on clayey soils, where water is near the surface. It forms a very large portion of the pasturage in Bengal, where, as Roxburgh observes, the fields are white with it when in flower after the first rains in April and May. Cattle relish it, when young. The Telingas make use of it in their marriage ceremonies. In Australia it is called 'blady grass;' and the young succulent foliage, which springs up after the occurrence of a fire, is much relished by stock. I have observed the same effect resulting from periodical fires on certain parts of the Himalaya, where the grass is plentiful.

In external appearance it resembles the following grass, and is known to natives by the same vernacular name.

SACCHARUM, *Linn.*

S. spontaneum, Linn. *S. Ægyptiacum.,* Willd. Enum., herb. Ber. I. 82. *S. semidecumbens, S. canaticutatum,* Roxb. *Fl. Ind.* I. 236 and 246.

Ver. *Kan, Bochri, Dharbi.* (West Khandeish.) Common all over India in the plains and on the Himalayan slopes up to 6,000 ft. Used as a fodder for buffaloes and also for thatching. Young elephants also feed on it. In Ceylon it is very common in gardens and fences, and its long white silvery panicles and tall culms give it a very gaudy appearance. The leaves make good mats, used for various purposes.

S. officinarum, Linn., Daly and Gibs., *Bomb. Fl. Suppl.* 100.

Ver. *Uss, Serdi, Ghendery* (bits of the cane sold in the bazaar).

There are several varieties of sugarcane which, whether for eating or for being used in the manufacture of sugar, are more or less largely cultivated throughout India. The reed, after juice has been extracted, yields a strong fibre used in the manufacture of paper, for torches, and as fuel in certain parts. The leaves are given as fodder.

The following varieties of sugarcane are cultivated in the Bombay Presidency :—

Pundia is thick, white, soft cane, yielding a comparatively watery juice, but gradually driving all others out of the field, wherever sufficient water is available for its cultivation, as it is vigorous and yields good crop. I believe this is the *Mauritius Cane.*

Striped Cane or *Bamunee.* It is of less vigorous growth, but is somewhat richer in sugar than the former.

Dark purple, or '*Kala.*' It is hard and gives rich juice ; is hardy in respect of living with less irrigation than the others, but it flowers every year, and this must lead to a loss of sugar.

There is a fourth variety, that grows to a great length with the thickness of the thumb. It is grown in the Mawal districts and thrives with very little water. The most profitable of all is *Pundia.*

The fibres left after the juice is expressed are regularly used as fuel to boil the cane juice, very little other fuel being used for this purpose.

S. ciliare, Anders., *S. munja,* Rox. *Fl. Ind.* I. 244.

Ver. *Sar, Kana, Kairh, Munj.* Seen only in cultivation in Bombay gardens. It is of too coarse a nature to be used for fodder, except when quite young ; it is used, however, in districts where it grows spontaneously, for many other purposes ; *e.g.*, in the manufacture of matting, rope, paper, and for thatching ; the stems are made into screens, sieves, and baskets, the thicker portion of the stem is used for lining walls and in the construction of chairs and couches. In the Jhang district of the Punjab, it is stated that in the cold weather the leaves are often the only pasturage for the cattle. They (the leaves) are also chopped up and mixed with *bhusa,* with grain, oilcake, or green stuff. In the early spring the grass is fired and the cattle graze on the green shoots that quickly sprout again. (*Jhang Settlement Report,* page 23, *vide* Duthie.)

POLLINIA, *Trin.*

P. argentea, Trin. Act. Ac. Petersb.; *P. tristachya*, Thw. Enum. 368, Andropogon tristachius, Roxb. *Fl. Ind.* I. 256.

Ver. *Chota Kussal, Roira* (Roida).

Common in Lanowlee and all over the Presidency and other parts of India. Eaten by cattle when young. Used at Poona for brooms and thatching. When old it is not suited for fodder, the fibres being hard.

P. eriopoda, Hance in *Journal of Bot.* IV. 173; *Spodiopogon angustifolius*, Trin. Spec. Gram. 336. Is said to exist at Mahableshwar—not seen by me.

SPODIOPOGON, *Trin. Fundam.*

S. Albidus, Benth. *Jour. Linn. Soc.* XIX., 66.

Andropogon rhizophorus, Steud. Syn. Pl. Glum. I. 381.

It is found all over India; not common. My specimens are from North Kanara.

ARTHRAXON, *Beauv. Agrost.*

A. Lanceolatus, Hockst. in Flora. All over India, in Deccan and Nepal, and in China.

A. echinatus, Hockst. in Flora; *Batratherum echinatum*, Nees in *Edin. Phil. Jour.*

Ver. *Marvel, Kadulia-marvel.* All over India, very common in Lanowlee and over the ghâts. Said to be 'good cutting and grazing,' especially when young. It is not eaten by horses. The murication on the external surface of the outer glume of the hermaphrodite spikelets varies in different specimens. This grass is described by Prof. Hackel as a variety of the last.

A. microphyllus, Hockst. in Flora. Common all over India.

A. lancifolius. Hockst. in Flora. *Andropogon lancifolius*, Trin. Mem. Ac. Petersb., is a variety of *Arthraxon mycrophyllus*, Hockst.: also *Arthraxon Mollis* or *Batratherum Molle*, Nees, is a variety of the last species. In both these varieties sessile spikelet is solitary, especially on the upper part of the spikes. Their vernacular name is *Furadyache gavat.* They are common in the rainy season in Bombay, Lanowli, the Western Ghâts in general, Poona and Nasik. Often seen growing on the top of old walls. Good fodder for cattle.

A. ciliaris, Beauv. Agrost. Plate XI., fig. 6. Ver. name *Turade, Turde.* Found in Lanowli and Sattara: eaten by cattle.

A. nudus, Benth. in Linn. Soc.'s Journal. *Batratherum nudum*, Nees in Steud. Syn. Pl. Glum. I. 383.

Ver. *Kesya-turda, Nangar-modi, Gondal, Marvel* (Thana name). Not uncommon over the Ghâts, Lanowli. It is eaten by cattle. This is described by Prof. Hackel as a variety of *A. ciliaris*.

A. quartianus, A. Richard, *Tent. Fl. Abyss.* II. 448, Plate 99; *Pleuroplitis plumbea*, Nees, Steud. Syn. Pl. Glum. I. 414. Found all over ghâts in Kanara and other districts of this Presidency.

A. micans, Hockst. in Flora; *Batratherum micans*, Nees in Anal. and Mag. Nat. Hist. Found in Poona and over Ghâts; also Dehra Dun and Agarwalla. Not common. Described by Prof. Hackel as a variety of *Arthraxon cuspidatus*, Hockst.

APOCOPIS, *Nees.*

A. Wightii, Nees; *Andropogon courtallamensis*, Steud. Syn. Pl. Glum. I. 377.

There are in the collection received from North Kanara specimens which agree in all particulars with the plant described as a sub-species *A.* Var. *A. typicus*, except that the culm is not branched. It appears, however, that these specimens are from plants collected in Ganjam, Madras.

OPHIURUS, *R. Br.*

O. corymbosus, Gaertn. fil, Carpol. Plate 181; *Rottbœllia corymboa*, Roxb. Corom. Pl. Plate 181.

Ver. *Sputter, Sut, Sonthi, Katia, Karvel.* Very common all over India. Used for thatching and tying bundles of grass; as fodder when young, or before flowering, and when other kinds fail.

O. perforatus, Trin. in Mem. Ac. Petersb.; *Rottbœllia perforata*, Roxb. Corom. Pl. Plate 182, Pl. Ind. I. 356.

Ver. *Sassur, Satgitna Kurke.*

All over this Presidency, in Madras, Neilgherry, in Bengal, and in Himalaya up to 5,000 ft. Also in Nepal and Ceylon. It is said to be common at Satpuda, West Khandeish (in uplands), and used as fodder for cattle. It is not uncommon in the low-lying land in the plains of the N.-W. Provinces, where cattle eat it when young and green.

ROTTBŒLLIA, *Linn. fil.*

R. exaltata, Linn. fil, Suppl. 114; Roxb. Corom. Pl. Plate 157, *Stegosia Cochin-Chinensis,* Loureira Pl. Cochinchinens, 51.

Ver. *Barsali, Bura, Sooate, Konda, Panookoo.* Grows all over India, Ceylon, Burma, Cochin-China, Java, China and Philippine Islands; also in Africa and North Australia. I received specimens from Yellapa in North Kanara. In Himalaya it ascends up to 4—5,000 ft.

R. gibbosa, Hack.

An erect grass. Stem 2 feet and more, leafy, smooth and glabrous, when devoid of the sheaths, branched from the upper half or two-thirds. Branches small, sheaths shorter than the internodes, striated, closely appressed, rather smooth or slightly hisped with few hairs. Nodes with a ring of hairs. Ligula 1 lin. long, fimbriato-celiolate. Leaves 5—6 in. long, 5 lin. broad in the middle, acuminate at the end and narrow at the base, ending gradually into the sheath, scabrous, studded with hairs minutely tubercled at their base; middle rib white, prominent. Panicle long, terminal, consisting of many branches with a bract or leaf sheath at the base of each branch. Spikes of a pale yellow colour, friable, slender, glabrous, about ½—1 in. long, 1—2 in the axils, solitary on each peduncle with a close sheathing bract at the base of each. Articles equal in length to sessile spikelet. Sessile spikelet broadly oval, obtuse, 1 lin. long. 1st glume rather gibbous at the lower part, and there bearing very short sparsely scattered hairs, chartaceous 3 to 5 nerved; the edges are slightly turned in at the upper part. 2nd glume a little smaller, ovate, chartaceous, but thinner than the first, indistinctly 3-nerved. 3rd glume smaller than the second, hyaline, with no trace of flower in the axil. 4th smaller than the 3rd, palea not seen. In some spikelets seeds are found. Pedicillate spikelet consists of a single lanceolate, or rather of a spatulate glume, with the upper end being slightly bent inwards or towards the rachis. No hairs.

This grass has a very close affinity to *R. formosa,* R. Br., except that the hairs on the lower part of the first glume, which is bulged out or gibbous, are very few and short. No hairs on the upper part of the articles. The pedicillate spikelet has no wing.

In September of last year (1890) Mr. Talbot of Kanara sent me specimens of this grass marked " New species of Mainsuris." Finding however that it was a species of *Rottbællia*, hitherto undescribed, I wrote down in my note-book the description above given, naming it *R. Talboti* after Mr. Talbot. In February last (1891) Mr. Duthie wrote me saying that in the collection of grasses sent by Mr. Talbot to Polten, Hungary, Mr. Hackel had identified one as a new species of *Rottbællia* and named it *R. gibbosa*, and in May last, at my request, kindly forwarded me a specimen, which turned out to be the one I have described above. I think the name of *R. Talboti* ought to have the honour of priority if Professor Hackel has not as yet published his description.

R. divergens, Hack. Androp.

A small cespitose plant named *Marel* at Mahableshwar.

Culm, slender, straight, or slightly geniculate, 6—9 in., branching from the base, glabrous. Nodes 2 or 3 only, hairy. Sheath 1—1½ in. long, shorter than the internodes, loose and carinate. They and the leaves with numerous hairs form a minutely papitose base. Ligula about 1 lin., hairy, jagged. Leaves 3—4½ in. long by 2½ lin., straight, acuminate, complicate, arising insensibly from the sheath without outward sensible distinction (only the ligula marks the distinction between the 2).

Racemes of light or pale yellow colour, somewhat compressed, generally falcate, simple, solitary, 1—1½ in. long, rather thick, terminal, elevated each on its filiform, jointed, sheathed peduncle of various lengths. The end of the peduncles and the articles of the rachis from which the racemes or spikelets have fallen off, are marked with a round cavity.

Rachis glabrous. Spikelets 2, pedicillate and sessile. Sessile spikelets 3 lines long without the awn, 5 lin. with the small awn.

Outer or first glume, coriaceous, elegantly muricated at the lower half with the crooked points turned upwards: the upper part surrounded on each side by a thin white (somewhat transparent) membranous wing with a small awn, 3 lin. long arising from the inner margin of each wing, straight but slightly diverging, from the awn of the opposite side.

2nd glume thin, acute, membranaceous unawned, not muricated, about 1—1½ lin. long.

3rd glume 1¼ lin., transparent, acute.

No flower seen in the axil.

4th glume 1 lin. long with a seed.

As the grass was in seed no stamens nor pistil could be found.

Pedicillate spikelet. Pedicel, about 1 lin. 1st glume, chartacious with several (7) nerves, not muricated, with transparent, rather triangular wing, as in the first glume of the sessile spikelet, on one side only.

2nd glume smaller, thinner, boat-shaped, with a transparent wing on the upper part of the keel, terminated by a short straight awn.

No other glumes, stamens, nor pistil seen.

This grass is named *R. divergens* in consequence of a suggestion thrown by a high authority in England. It appears, however, to be a distinct species of *Rottbœllia*, differing from *R. divergens*, chiefly by the murications and awns of the first glume of the sessile spikelet and awn of the outer glume of the pedicillate spikelet.

MANISURIS, *Swart. Fl. Ind. Occid. I.* 186.

Manisuris granularis, Linn. fil Nees. Gram. Gen. Roxb. Corom., Pl. Plate 118 ; Dalz. and Gibs., *Bomb. Fl.* 300.

Ver. *Kangni, Datura Ghas.* Very common on barren land in this Presidency and all over India, on Himalaya up to 5,000 ft. Also in the Neilgherries, Kamaon, Nepal, Assam, Kassia mountains, Java, China, Brazil, Peru, and in all tropical and sub-tropical countries. " Mr. Coldstream says that it is both grazed and stacked at Hissar, Punjab, but it is not much relished by cattle. At Ajmere it is considered to be a good fodder grass."

THELEPOGON, *Roth.*

T. elegans, Roth. Nov. pl. spec. 62 ; *Jardinea Abyssinia*, Steud. Syn. Pl. Glum. I. 360.

Ver. *Tirpha, Kadi.*

This is a beautiful grass 2—3½ ft. high. Its spikelets resembling externally those of *Ischaemum rugosum.* Is common in Poona, Nasik, and all districts of this Presidency. It grows on the sides of the roads and boundaries of the cultivated fields: also in tropical

Africa, Hills of Abyssinia, and is said to be used by cattle and horses when young and green.

Ischaemum, Linn. Gen. Plant.; *I. aristatum*, Linn. Spec. Plant. Several varieties are described under different names by different authors. Dalz. and Gibs. *Bomb. Fl.* 306.

1. *I. imberbe*, Retz. obs. VI. 35; *I. aristatum, Burm. Fl. Ind.*, Plate 21, fig. 3 (not good).
2. *I. mangaluricum*, Hack. Androp. 204.
3. *I. geniculatum*, Roxb. *Fl. Ind.* I. 322.
4. *I. elatum*, Hack. Androp. 205; *Meoschium elatum*, Nees in Steud. Syn. Pl. Glum. I. 376.

Ver. This variety is known to natives as *Bangadi, Khanden.* It grows all over India, Ceylon and at Hong-Kong. The plant seen by me in Lanowlee is rather small.

It is a good fodder, eaten readily by cattle.

I. conjugatum, Roxb. *Fl. Ind.* I. 321, Dalz. and Gibs. *Bomb. Fl.* 305, *Andropogon cordatifolius*, Steud. Syn. Pl. Glum. I. 376.

Ver. *Ber, Bher, Bar, Khanden, Bhangadi.* Mr. Davidson of the Survey Department and others state that it is a very good fodder.

Received specimens from Konkon, Kanara, Malabar. It grows also in Bengal and Ceylon.

I. rugosum, Gaerten. Carp. Suppl. p. I. Pl. 181; Dalz. and Gibs. *Bomb. Fl.* 305.

Ver. *Laz, Bardi, Bar, Bher, Karkel, Tiki, grass.* Common all over India, Serampur, Kamaon, Silhet, Nepal, China, Canton, Philippine Islands and Timor. Good fodder when young: not fit to cut or stock, as the stems are easily broken when dry. Grows with rice plants and injures it. Davidson.

I. semisagitatum, Roxb. *Fl. Ind.* I. 321.

Ver. *Dalaga, Ber, Saj-Kadi* or *Kari* (Mahim name). Not common. Received specimens from Kanara, Thana and Sattara. Mr. Fergusson says it is a good fodder grass.

I. ciliare, Retz. Obs. VI. 36; *Andropogon in Retzü* and *A. certus*, Steud. Syn. Pl. Glum. I. 375. Professor Hackel describes several varieties. *I. prorepens*, Hack; under which is placed *I. tenellum*, Roxb. *Fl. Ind.* I. 323.

I. villosum, spodiopogon villosus, Nees; *I. malacophyllum, Andro-*

pogon malacophyllus, Steud. Syn. Pl. Glum. I. 372; *I. aristatum,* Roxb. *Fl. Ind.* I. 319. All these varieties are seen by me; a few others mentioned by Hackel, l. c. have not come under my observation.

Ver. *Bara, Bher.* All over India, Burma, Ceylon and China; seldom used as a fodder grass. Mr. Fergusson, under *Spodiopogon obliquivalvis,* describes 3 varieties or forms. "The larger hairy form occurs at a considerable elevation on the hills." Another form of this grass, reserved in fields and under the shades of cocoanut trees in and near Colombo and extensively brought into town as fodder for cattle, is well-known as the Rat-tana, literally red-grass, of the Sinhalese.

It appears that Fergusson describes two species of *Ischæmum* under the name of *Spodiopogon obliquivalvis.*

I. Timorense, Kunth., Revis. Gram. I. 369, Plate 98; *Spodiopogon Blumii,* Nees., Steud. Syn. Pl. Glum. I. 376. A slender grass. Culm 8—20 in. long, somewhat compressed, creeping and rooting from the lower nodes, branching from the middle ones; the upper part reduced to a naked peduncle. Nodes short-bearded. Sheath glabrous, ciliate at the mouth. Ligula short, truncate. Leaves very narrow at the base, linear-lanceolate, 3—4 in. long, acuminate, scabrous at the margins and sprinkled with adpressed hairs. Racemes 1—1¼ in. long, 2 in number—one sessile, and the other on a short (about 31 in. long) pedicel, yellowish. Rachis and pedicels of spikelets with yellowish hairs. Sessile spikelet: 1st glume 3—5 nerved, hairy at the base, glabrous on the dorsum. 2nd glume bidentate, one of the teeth drawn into a slender awn-like point. 3rd glume hyaline, thin, with a male flower (anthers and palea) in the axil. 4th glume by a line divided into 2 lobes, and sending a slender bent and twisted awn about 4—5 times longer than the spikelet. A hermaphrodite flower in the axil of this glume. Pedicillate spikelet: 1st and 2nd glume with a short straight awn. The remaining glumes as in the sessile spikelet. Received specimens from North Kanara. It grows also in Ceylon, Java, Timor, Pegu, Martaban and Singapur. Nothing is known of its uses.

I. petiolare, Spodiopogon petiolaris, Trin. in Mem. Ac. Petersb. *Pollinea Latmanni,* W. Ar. and Nees Pl. Meyen. 186. *Andropogon* *petiolaris*, Steud. Syn. Pl. Glum. I. 398. *A. petiolatus*, Dalz. and Gibs. *Bomb. Fl.* 303.

Ver. *Nanjdi, Rhalphil, Philphil, Kallil, Pharavi* (the latter name is also given to *I. pillosum*). Said to be good fodder for cattle.

I have not seen specimens of the leaves of *I. petiolare* with a petiole 4 in. long, nor does any author, so far as my reading goes, describe it of that length. I have not observed petioles longer than ¾—1½ in. Mr. Dalrell says: "A remarkable grass (*I. petiolare*), the existence of a distinct petiole being extremely unusual in grasses." It is strange that none of the Indian botanists have described the petiole which exists in some forms of *I. semisagitatum*, Roxb. and *I. conjugatum*, Roxb. This omission has caused great embarrassment to the students of grasses. I know of instances in which specimens of *I. semisagitatum* were sent to me for identification of the specific name. It is stated by Prof. Hackel that the leaves of *Spodiopogon albidus* are also distinctly petioled.

I. pillosum, Wight, *Madras Jour.*, Sc. Dabr., and Gibs., *Bomb. Fl.* 305; *Spodiopogon pilosus*, Nees, Steud. Syn. Pl. Glum. I. 373.

Ver. *Koonda* (also named *Pharari*).

Common in the Deccan. I have received specimens from East and West Khandeish, Bhooj, Sholapoor and Sattara, where it is called *Koonda* or *Dungri Koonda;* it grows also in Maisur, Assirghar, Bellari and Chanda. It is a good fodder. One report from Poona says it is a good fodder when young.

I. laxum, R. Br. Prodr. 205; *Hologamium nervosum*, Nees, in Edin. N. Phil. Jour.; *Andropogon nervosum*, Rottb.; *Ischaemum nervosum*, Thwait. Enum. Pl. Zeyl, 365.

Ver. *Suckal, Shali, Sheda, Pavna, Bal.* All over the Presidency, also in Ceylon, Australia, Abyssinia, Arabia and Cape Verde. Said to be a good fodder. Often used for thatching in West Khandeish. This is often confounded by natives with *Heterpogon contortus*, Roem. and Schult, being named *Bal*, name generally given to the latter.

I. sulcatum, Hack. *Andropogoneæ*, 248.

Ver. *Sheda, Pavna.* Species received from Sattara and Sholapoor, from Malsiras (Sholapoor taluka). Nothing is known about its uses.

I. ramosissimum, Hack. Andropogoneæ 249.

Ver. *Diedia*, *Beyla*, *Bal-Garut*, *Kadbrieber*, *Bhas* (name also of *Apluda aristata*) *Barcthi Canther*

Very common at Lanowlee, Khandala, and over the ghâts down to the foot.

In my notes taken three years ago I had named it *I. nutans*, on account of its numerous nodding spikes, believing it to be a new undescribed species. At that time Prof. Hackel's monograph had not been published, and I received a copy of it only last year. The plants seen in our ghâts differ in a few particulars from the description given by Hackel.

HETEROPOGON, *Pers.*

H. contortus, Roem and Schult II. 386, *H. hirtus*, Pers. Syn. II. 533. *Andropogon contortus*, Linn. Roxb. *Fl. Ind.* I. 258; Dalz and Gibs., *Bomb. Fl.* 300.

Ver. *Suckali Koossal*, *Pandri-Suckali*, *Bal*, *Sukery*, *Bale*, *Mussaneh*, *Suckal*, *Itali-Suckal*, *Dakli Suckal* (small suckal—to distinguish it from the next large species). Spear grass of the Europeans.

Very common all over India, ascending up to 1,000 ft. on the Himalaya and Afghanistan; all over Africa (Central Africa, Serpa Pinto), Timor, China, Macao and in Brazil.

This grass is very troublesome, the dry spikelets with their long twisted awns which fall easily, acting like barbed arrows. All the awns are twisted together like the strands of a rope.

From the reports received from all parts of the Bombay Presidency, it appears to be considered a good fodder grass, especially when it is young and green. In East Khandeish it is used as a thatching material. Mr. Duthie says: "In Rájputána and Bundelkand, where this grass abounds, it is cut and stacked after the rains are over. It is also cut for hay in the Hissarbir, and Mr. Coldstream states that it will keep good in stack for 12 years. On Mount Abu the people consider it the best fodder grass they have. In other districts it is said to be eaten only by buffaloes, or by cattle when they are hungry and cannot obtain other kinds of grass. It is much used for thatching. The spears when the spikes are ripe, adhere in masses, are called *sali* at Ajmere. In Australia it is looked upon as a splendid grass for a cattle run, as it produces a great amount of feed. In this Presidency it is not credited with such high properties.

Andropogon polystachius, Roxb. Fl. Ind. I. 261 ; Dalz. and Gibs., *Bomb. Fl.* 301, is a variety of *Heteropogan contortus* with fasciculated spikes. The authors of the Bomb. Flora say " Rather a rare grass. Our specimens were found on the western side of the Mahableshwar hills." This variety is found in Lanowlee, Khandalla, and other districts of this Presidency, growing along with the typical species.

H. insignis, Thwart. Enum. Pl. Zeyl. 437 ; *Andropogan triticens*, R. Br. Prodr. 201.

Ver. *Motti Kussal, Bale, Patang.*

All over the Presidency ; also in Burma, Ceylon, Philippine Islands, Java and Australia.

LOPHOPOGON, *Hack.*

L. tridentatus, Hack. Andropogon. 254 ; *Andropogon tridentatus*, Roxb. H. Ind. I. 257 ; *Apocopis tridentata*, Benth. Jour. Linn. Soc. xix. 67.

Ver. *Reda*, *Yerke*, *Alli-Kussal* (*Alli* means buffalo), *Gonda*, *Chirka.*

Grows all over India. Common in this Presidency, very common in Poona, where large tracts of fields occupied by this grass have a peculiar yellowish (ferruginous) look. Cattle do not seem to relish it ; it is eaten only when young; said to be eaten by buffaloes in Sholapur.

ANDROPOGON, *Linn.*

A. fastigiatus, Sw. Prod. 26 ; *Fl. Ind.* sec. 207.

This is a tall grass with long narrow leaves and long leafy panicle, and, I believe, it is rare in this Presidency. My specimens are from Kandwa, sent by Dr. Dymock. It is also found in Central India, tropical Africa, Brazil, Mexico, Jamaica, Cuba, Peru, Venezula, Abyssinia, &c.

A. foveolatus, Del. Descr. de l'Egypt, Plate 8, Fig. 2. *A. monostachyus*, Spreng. Pug. II. 9.

Ver. *Marwel*, *Boavri*, *Kard gandhel.* In East and West Khandeish, and in the Deccan on rocky grounds. Also all over India, Sindh, and tropical Africa. Admitted to be a good fodder.

A. strictus, Rox. *Fl. Ind.* I. 261. In the Deccan and in North Karwar. This is described by Hackel as a variety of *A. faveolatus*, Del.

A. pachyarthus, Hack, Androp. 449. *A. humilis*, Wight; *A dimissus*, Steud. Syn. Pl. Glum. I. 388.

Ver. *Lall gavat* (so named on account of the red colour of the spikelets), *Tambrut, Gondad, Chiman Chira, Malakara.* Very common in Poona, in Khandeish (West and East), Karwar, and all over India. It resembles very much *A. pumilus*, Roxb. Reckoned to be a good fodder grass, especially before it flowers. Duthie says that it is "good for cattle, but not for horses."

A. pertusus, Willd. Spec. IV. 922.

Ver. *Ganya marvel* (Sattara and Sholapore name), *Payen, Palva, Palwan.* It is common in Poona, also in Sattara, Sholapore, Kanara, and all over the Presidency, and in other parts of India, in Africa and Abyssinia. It is reckoned as a good fodder grass. It is said "This grass, which is met with all over the plains of Northern India, is universally esteemed as a good fodder grass, both for grazing and stacking. In Australia also, it is highly valued, being regarded as one of the best grass to stand long droughts, while it will bear any amount of feeding. It is useful also as a winter grass, if the weather is not too severe." I have not seen it eaten by cattle. There are two varieties of this species—one with two piths on the outer glume of the pedicillate spikelet, and the other with three piths. This was collected by Major Serpa Pinto in Central Africa. The infloresence of this grass is scented, a circumstance which is not noticed by any agrostologist I know of.

A. intermedius, R. Br. Prodr. 202; Benth. Fl. Austral. VII. 531; *A. fascicularis*, Thwait. Enun. Pl. Zeylon, 437.

Ver. *Kolum.* It is intermediate between *A. ischæmum*, Linn., and *A. pertusus*, Willd. Resembles these species in general appearance, but the panicles are more loose and more elongated. Grows all over India; it is a tall and coarse grass with long narrow leaves; is used in Mahableshwar for thatching.

A. punctatus, Roxb. Fl. Ind. I. 264. *A. perfossus*, Nees Steud. Syn. Pl. Glum. I. 391.

Ver. *Kunda.* My specimens are from Poona and East Khandeish.

In the latter place it was collected in the villages of Jalgaon, Amalwar and Pachora. Said to be used as fodder and in thatching. Prof. Hackel describes it as a variety of *A. intermedius,* R. Br., it is distinguished by a shallow pith on the outer glumes of the sessile and pedicillate spikelets. "It occurs in the hilly parts of Northern India, and is abundant on the Himalaya up to moderate elevations. The Seoni specimens have three shallow piths on the outer glume of the sterile florets, and one deep pith on the outer glume of the hermaphrodite floret."

A. glaber, Roxb. *Fl. Ind.* I. 267 ; Trin. Sp. Glum. Plate 328.

Ver. *Tambat.* The spikelets are marked with piths as in *A. punctatus,* but not always even in the same spike. It is also described by Hackel as a variety of *A. intermedius,* R. Brown. Is one of the common fodder grasses of the Deccan. Roxburg states that it is thinly scattered on rather elevated spots over Bengal. In the North-Western Provinces it is found in localities similar to where *A. annulatus,* Forsk, grows, but not in such abundance.

A. montanus, Roxb. *Fl. Ind.* I. 267. Specimens received from Dharwar. It is an elegant grass, reckoned to be a good fodder. *A. glaucopsis,* Steud. Syn. Pl. Glum. I. 397 ; *A. subrepens,* Steud. l. c. At Dharwar ; also in Nepal and Burma, specimens received from Mr. Talbot.

A. odoratus, Lisb.

Vern. *Bhos, Vedi-Gavat, Tambrut.* Under this name Mrs. Lisboa has described a beautiful, tall, highly-scented grass, very abundant at Lanowlee, and the neighbouring villages, Thana, Jalgaon, Chopada, in East Khandeish, and, perhaps at Khandalla. It has a close affinity to *A. intermedius,* R. Brown, but is distinguished from it by not branching as much as the latter, the leaves being shorter, and branches not so long and narrow as in *A. intermedius* ; nodes being always covered with long white hairs, the rachis and the spikelets being also very hairy, and the whole plant, leaves, and the infloresence highly scented. It is named *Weddi-Gavat* by the inhabitants of Lanowlee.

The following description is taken from Mrs. Lisboa's paper read at the Bombay Natural History Society Meeting on 7th August, 1889.

"Culm erect, 3—5 ft. high, sometimes branching from the lower part, glabrous. Nodes long-bearded. Leaves lanceolate, cordate at the base, acute or acuminate, with a few long hairs; the lower cauline leaves long, the upper small, but their sheaths very long. Ligula small. Spikes numerous, erect, branched, pedicellate (the pedicel of the lower spikes longer) and congested at the end of a long peduncle without a sheathing bract, and forming an erect, dense, ovoid panicle. The rachis, pedicel, and the spikes covered with long silky hairs. The spikelets nearly two lines long, of a purple colour; the sessile and the pedicellate similar. Outer glume of the sessile spikelet rather thin, many-nerved, somewhat obtuse, and covered with long silky hairs, with a pith in some spikelets of the same plant and absent in others; second glume as long as the first, or a little longer but broader, thin, and keeled; third glume thinner and hyaline, fourth glume smaller or an awn $\frac{1}{2}$—1 inch long, with an hermaphrodite flower at the end of the pedicel. Pedicel of the pedicellate spikelet with white hairs, but the spikelets almost free of hairs. Outer glume with five or more nerves, not prominent, almost obtuse; second glume thinner, with three nerves, somewhat broader but as long as the first; third glume hyaline, smaller; fourth glume very small, hyaline, or none; no awn; at the top of the pedicel three stamens, not well formed, and not as large as in the hermaphrodite flower.

"This grass is common at Lanowlee on the right side of the station, in the fields beyond the woods, where it grows along with *Pollinia tristachya*, Thw., *Ischæmum laxum*, R. Brown, *Arundinaeca Nepalensis*, Trinn., and other annual grasses. The purple-coloured spikes of *A. odoratus* and *Pollinia tristachya* congested at the end of long peduncles, form a most elegant and beautiful feature of the scenery of the field towards the end of the rainy season. It is said to be not uncommon at Khardi, Thana. I have found it in the collection received from this district."

"From the description and from the specimen laid on the table, you will see that this *Andropogon* belongs to the section *Gymnopogon*, and is different from all other aromatic *Andropogons*, and as I believe it to be a new species, I have called it, as I have said above, *A. odoratus*. The leaves and the infloresence also, when pressed between the fingers, emit an odour altogether different. If you examine the small quantity of oil, of a beautiful gold yellow colour, which is on the table in a tiny little glass tube marked *A. odoratus*, and compare it with that of *A. Martini* in another similar tube, also on the table, extracted by Mr. Prebble of Messrs. Kemp and Co., you will certainly pronounce that the odour of the new species is soft, sweet, and more agreeable than that of *A. Martini*; and if it be manufactured on a large scale with great care and by an improved process, if practicable, it may prove superior even to that of *A. nardus*, and *A. citratiis*."

Andropogon Hügelii, Hack.

Var. *Andropogon fœtidus*, Hack.

Ver. *Chiman-Sar* (Salsette name), *Podan*.

The following is what Mrs. Lisboa says about this grass in her paper read at the Bom. Nat. Hist. Society's Meetings, held on 3rd April, 1891.

This is a new *Andropogon*, hitherto inedited. Mr. Madon, Forest Officer of the Thana District, was the first to send to Dr. Lisboa a sweet-scented grass named *Podan* on Jan. 7th, 1889, and some better specimens of the same in November of the same year. At his request Dr. Lisboa informed him of having identified it as *A. Hugelii*.

"Culm 2½—4 ft. or more, slender, branching, decumbent and sometimes rooting near the base, roundish, grooved on the side of branches and leaves, smooth, glabrous, of a pale purple colour. Sheaths smooth and polished, lower rather loose, upper appressed and somewhat carinate, glabrous, shorter than the nodes. Nodes bearded with soft white hairs. Ligula 1 lin. long, truncate, ciliated. Leaves 5—8 in. long, 6 lin. broad, upper, smaller, linear, lanceolate, narrow, rotundate at the base, terminated gradually into an acute point, sparsely sprinkled with hairs on the lower surface, few or none on the upper, scabrous on both surfaces and margins, distinctly divided into 2 unequal parts by a white rib, prominent on the lower surface.

Panicle 5—7 in. long, erect, oblong, much branched, supported on a long peduncle without a sheath. Rachis of a faded purple colour, smooth or scabrous from minute tubercles; nodes 6—9 or more; internodes longer.

Branches many at each node (6—12 at the lowest), alternate, capillary, smooth or scabrous, semi-verticelled, unequal in length, the longest often 5—6 noded. Nodes both of the primary rachis and of the branches swollen and bearded, with soft white hairs.

Primary branches give out at each node 2—3 secondary branches, and these in their turn yield smaller tertiary branches; the ultimate branches and the smaller primary ones bearing 3 terminal spikelets, one sessile and two pedicellate, and generally 3 pairs below the triplet. Racemes very fragile, supported on peduncles free from hairs. The articulations of racemes and pedicels of the pedicellate spikelets short, hairy. Both sessile and pedicellate spikelets about 1½ lin., dull, yellowish-white or dingy-green with a tuft of hairs at their base.

Sessile spikelet linear oblong, 1st glume 7—9 nerved; apex obtuse; margins slightly turned in, often ciliolate; the dorsum scabrous.

2nd glume equal to the first, rather broad, obtuse at the apex, 5-nerved, glabrous.

3rd not seen (absent in all the specimens examined).

4th a very slender awn nearly 1 in. long, twisted to a little above the middle. The twisted part dark brown, the upper portion straight and light-coloured. An hermaphrodite flower in the axil.

Pedicellate spikelets linear, oblong; 1st glume obtuse at the apex, ciliolate at the margins towards the upper half, many-nerved.

2nd glume similar to the first, 3-nerved.

3rd glume hyaline, obtuse, nerveless, shorter but broader than the last two.

4th none, stamens 3, anthers one lin. long.

"It is common all over the Presidency, especially in Bassein, Thana, and over the ghâts. Specimens have been received from Thana under the names of *Podan*, *Koola-Sippie*; from Bassein, under that of *Tam*, *Kullus*; and from Bheundy, where it grows along the embankments and in the Mahals. In the latter place it is called *Padra*, and is used as fodder, but no oil is extracted. The infloresence is scented, the odour being soft and very pleasant, or, in the language of Mr. Duthie, "deliciously scented." Hence the name *A. fœtidus* given to this plant is, you will admit, inappropriate. But perhaps the sense of smell like that of taste may differ in different individuals. So far as I know, no agrostologist, not even Mr. Hackel, has yet described it. When towards the end of 1889 we were informed that Hackel, considering the specimens sent to him by Mr. Duthie as belonging to a new *Andropogon* had named it as above, it was suggested by me that *A. Hackelii* in honour of Professor Hackel would be a more appropriate name. To this, in a letter dated 13th November, 1890, Mr. Duthie answered "I think *A. Hackelii*, Lisboa, would be a far more appropriate name. I should think he would have no objection to the alteration, I had better ask him." I would have still described it in honour of Prof. Hackel but for the following letter of Mr. Duthie, dated 31st January last.

"Professor Hackel now reduces his *Andropogon fœtidus* to a variety of *Hugelii*, Hackel. He first gave the name *A. fœtidus* to specimens collected by me in the Nimar district two years ago. He did not reply to my question regarding the inappropriateness of the name *fœtidus*. He has probably written a description which will shortly be published."

The description given in this paper is mine: so far as I know, Mr. Hackel has not published his.

A. mitiacens, Roxb., *Fl. Ind. I.* 273.

Schult. Mant., II. 448.

Vern. *Narvas, Bhendu.*

Poona (rare), Lanowlee (saw only one specimen). Also mountains north of Oudh (Genl. Martini Roxb. *Fl. Ind.*)

This is a very tall stately grass, presenting a beautiful appearance when in infloresence, which is of a purplish colour. Nothing is known of its uses as a fodder grass.

A. squarosus, Linn. fil. suppl. 433. *A. muricatus*, Retz. *Obser. III.* 45; V. 20; Dalz. and Gibs, *Bomb. Fl.*, 302.

Vern. *Varelu* or *Valerum, Walla* and *Ushir, Vittiver* (South India name, Roxb.). Hence it is named *Vetiveria odorata* by Virey. The long aromatic roots are known as *Kaskas.*

It is common in southern districts of India, but rather rare in Thana and in other parts of the Bombay Presidency. In these, it is cultivated in gardens. Generally distributed throughout the plains of Northern India, especially on moist low-lying lands. It affords good fodder when young, and is much relished by buffaloes. It is not stacked as fodder, and the cut grass is given to cattle only in seasons of excessive drought. This grass is used largely as a thatching material, and the fragrant roots, known under the name of *khas khas* are used all over Northern India in the manufacture of tatties. In the Sirsa Settlement Report it is stated that the roots are dug up by the villagers, who sometimes pay the owner of the ground a small fee of 4 annas per digger, and that they are sold at about a rupee a maund to banyas, who send them to Lahore and Ferozepur. In the Jhang Settlement Report mention is made of the tough roots being used for making rope, and also the brushes used by the weavers for arranging the threads of the web. The brushes of the Saharampur and Dehra Dun weavers are of the same material. Baskets are made of the stems (sink) which are sometimes dyed. At Bhira, in Oudh, a perfume called *itar* is extracted, and used medicinally under the name of *uraiya*.

It is well-known that the roots of this grass, when dry, and then gently moistened, emit a pleasant kind of fragrance, they are employed to make large fans commonly called *Vissaries* and also screens which are placed before windows and doors, which, being kept moist during the hot winds, render the air that passes through them both cool and fragrant, Rox. *Fl. Ind.* 1. p. 266. Small fans are also made of the roots, and these dried and put into almirahs are useful in many respects. " Inscriptions on copper plates lately discovered in the district of Etawah, south-east of Agra, and dating from A. D. 1103 to 1174, record grants of villages to Brahmins by the Kings of Kananj, and enumerate the imposts that were to be levied. These include taxes on mines, salt pits, and the trade in precious metals, also on Mahwah (*Bassia*) and Mango trees, and on Cuscus grass. Pro. Asiatic Society of Bengal, August, 1873, p. 161. See Fergusson, Roxburg, and Duthie.

A. caricosus, Linn. Sp.; *A. serratus*, Retz. Obs. V. 21; Trin. Sp. Gram. plate 329; *Heteropogon concinnus*, Thwait, Enum, Pl. Zeyl. 368.

Ver. *Telia*, *Jetara*, *Chaoria*, *Patang*, *Marwel* (the latter name is common to more than one sp. of grass).

Specimens received from Lanowli, Shapur, and Khardi in Thana, Tapti valley, Callian; grows also in Central and North-Western Provinces, also in Ceylon and China. It is esteemed as a good fodder grass; eaten by cattle.

A. mollicomus, Kunt. Revis. Gram. Plate 96; Dalz. and Gibs. *Bomb. Fl.* 301.

Vern *Ganya Marwel,* whilst *A. caricosus,* Linn. fil., is known as *Marwel.*

It grows in Bombay, Nassick, Poona and Surat, and specimens received from Jamner and Bussawal where it is used as fodder. It grows also in Mauritius and Timor. "This has been hitherto supposed to be confined to Mauritius and Timor, but it is common in the black soil around Surat. It grows to the height of 4 to 5 feet." Dalz. and Gibs. *Bomb. Fl.* Hackel reckons it as a variety of *A. caricosus,* Linn.

A. tenellus, Roxb. *Flor. Ind.* I. 254 ; Dalz. and Gibs, *Bomb.* 301.

I have not seen this grass, which is described by the authors of the *Bomb. Flora* as a delicate tall grass, and found by them in Surat.

It has a close affinity to *A. caricosus,* Linn. fil. *A. binnatus* of Roxb. is thought to be approaching *A. caricosus,* Linn.

A. annulatus, Forsk. *Fl. Æg.-Arab* 179 A., *Bladhii,* Roxb. *Fl. Ind.* I. 259. Trin. Sp. Gram. Plate 325.

Vern. *Sheda, Sam, Payen, Palwan.* Poona, China, Macao, and tropical Africa.

Near Bamburda, Poona, said to grow up to 5 feet, and is esteemed as good fodder grass fit for cutting, stacking and grazing. Grows generally on river banks and mawal hills. It is a common grass about Colombo, where it is considered to be an excellent grass either in a green or dry state, and cattle are very fond of it.

Common all over the plains of Northern India by roadsides and in bushy places. It yields a considerable amount of fairly good fodder, which is largely made use of. It is very similar in habit to *A. Ischaemum* and *A. pertusus,* differing from the former by its blunt glumes, and from the latter by the absence of pith on the back of the outer glumes. Specimens with the outer glumes 3-dentate at the apex have hitherto been referred to *A. Bladhii,* Retz., but Prof. Hackel informs me that the true *A. Bladhii* is a Chinese variety of *A. annulatus."* Duthie.

A. scandens. Roxb. *Fl. Ind.* I. 258; Dalz. and Gibs *Bomb. Flora.* 301.

Vern. *Marwel* (name given also to *A. caricosus*). Common in the Deccan, where it is considered to be a good fodder. Roxburg however observes that it is a coarse grass. Cattle are not fond of it.

A. Bladhii, Retz obs. 11. 27. *A. obtusus.* Nees in Hook. and Arn. *Beechys voy.* 243, *exclus. syn.* Roxb.

It it said to be a variety of the last mentioned species of *Andropogon*, and is distinguished from it by the outer glumes being 3-dentate and the spikelets being loose and more remote from each other. It is named *Loari* in Bengal. Found all over the Presidency; Roxburgh says "It is a native of hedges and roadsides, but chiefly of old pasture ground."

Like *A. annulatus*, Forsk., it is a good fodder grass.

A. laniger, Desf. Fl. Atl. II. 379, *A. eriophorus,* Willd. Sp. IV. 910, *A. Olivieri,* Bois. Diagn. Pl. Or. V. 76.

Ver. *Iaramkush, Azkhir, Khari, Gandel, Runa, Dabsulo, Khair.*

It is rare in the Bombay Presidency; grows in Baroda, Sind, North Kanara and the Deccan. Also in the Punjab, Rajputana, and parts of the N.-W. Provinces, and in all arid mountainous places such as Afghanistan, Himalaya Occid., Tibet, Morocco, Arabia, and Persia.

It is not esteemed as a good fodder; eaten only when young and green by cattle, to whose milk it imparts its scent.

"This is one of the sweet-scented grasses, the roots of which are sometimes used like *Khas khas* in the manufacture of tatties. It is common on uncultivated land in Sindh, the Punjab, Rajputana, and parts of the N.-W. Provinces; it is also recorded from Tibet at an elevation of 11,000 feet. As a fodder grass it does not rank high in regard to its nutritive qualities. It is, however, largely made use of by cattle when it is young and tender. Its scent is said to affect the flavour of the milk. It is often stacked, and forms a useful supply in times of scarcity. Mr. Coldstream says that it will keep good in stack for upwards of 10 or 12 years. For horses it is not to be recommended. Mr. J. B. Hallen tells me that the natives of Chattar in Baluchistan state that the cattle eat it with impunity, but that horses suffer from colic after feeding on it. Col. Strong also mentions the same circumstance. In the Jhang Settlement Report it is stated that the Khair grass grows in hollows where water collects, and seems to prefer *kallar;* that cows graze upon it if hard pressed, but not otherwise; also that the housewives use wisps of this grass to clean out vessels used for churning and holding milk A perfume is manufactured from it, and the aromatic oil is sometimes used as a cooling medicine. For further information regarding the history and medicinal properties of this grass, reference should be made to Dr. Dymock's "Vegetable Materia Medica of Western India," p. 850.

A. Iwarancusa, Blanc, Phil. Transact., vol. 80, Plate 16; Roxb., *Fl. Ind.*, vol. I. 276; Dalz. and Gibs., *Bomb. Fl.*, 301, Trin. Sp. Gram., Plate 326.

Ver. *Ibarankusha, Iwarankusha, Kurankusha* (Hindust. and Bengali names, Roxb.) Dalz. and Gibs state, "The whole plant is aromatic. It is particularly mentioned by Arrian in his account of Alexander's journey through the Punjab and Sindh, and was gathered by the Phœnician followers of the army in Lus, who called it *Spikenard*. It is common about Karachi, and is used as a scent by the natives. It may be found in the Ahmedabad Zillah, but we think there is some mistake as to its having been found in the moist Concan as stated in Graham's Catalogue."

Grows also on the plains at the foot of the Himalayas, Hurdwar, Nepal, Nubia, Sennar, and Abyssinia. Mr. Hackel describes 3 varieties of this grass, and states that *Andropogon proximus*, Hochst., one of the varieties in Schimp. Pl. Abyss., cannot always be distinguished from *A. laniger*, Desf.

A. distans, Nees, Steud. Syn. Pl. Gram. I. 387, found in various parts of India but rare. Received specimens from North Kanara, and from the confines of Bombay near Madras, or rather from Raichore.

Mr. Hackel describes numerous varieties of *A. nardus*, Linn. Sp., *A. distans* being one of these.

A. citratus. This grass named *Oli cha* or *lili cha* (green tea) yields lemon grass or oil of verbena of commerce. It is found only in the cultivated state, and as it bears a close resemblance to *A. nardus*, Linn., it is probably one of its varieties. Mr. Hackel, *Andropogoneæ*, p. 608, says, "*A. citratus* D. (Cat. Hort. Monp. 78, *sine discriptione florum, aut ad A. nardum aut A. Schœnanthum pertinet*."

A. Schœnanthus, Linn., Sp. *A. Martini*, Roxb. *Fl. Ind.* I. 277. *A. pachnodes,* Trin. Mem. Ac. Petersb. Sp. Gram. Plate 327, *A. nardoides*, Nees, Fl. Afr. Austr. 116 ; Dalz. and Gibs. *Bomb. Fl.* 302, *A. Calamus aromaticus*, Royl. Illust. Him. Bot. 97.

Ver. *Rosa, Rosha, Rose* ; Ginger grass of Europeans, very common all over India, Australia, Ceylon, China, Macao, and Africa.

In this Presidency it ascends as high as Panchgunny, rare on the top of Mahableshwar. Of all the scented *Andropogons*, this is the best known, and an aromatic oil, called Rosha oil, is distilled from it at Khandeish. The cattle eat it, especially when young, the scent of which is said to be imparted to the milk. The dry grass is used by natives for thatching the roofs of their huts, and occasionally for making tatties. It appears from the Bombay Gazetteer, Vol. 12, that in Khandeish people distinguish two varieties, one with bluish and the other with white flowers. The oil produced from the first is of a green colour and is called *Sophia*, that from the other is white, and is called *Motia*. It is stated by Mrs. Lisboa in her paper read at the Bombay Natural History Society's Meeting held on 7th August, 1889, that the same plant bears infloresence bluish, white, and red at different stages of its growth, and that the colour and density of its oil may vary according to the process of distillation employed or according to the age at which the plant is cut and used. Dr. Dymock says that a large quantity (above 40,000 lbs.) of the Rosha oil is annually exported from Bombay to Red Sea Ports and to Europe. It is much used by Arabs and Turks as a hair oil, and by people of this country in rheumatism. But the most remarkable use made of this oil is that of adulterating *Attar* of roses in European Turkey. The Bombay dealers know nothing of its thus being employed to adulterate *Attar* of roses. In India sandal wood oil is used for the purpose. See Dr. Dymock's "Vegetable Materia Medica," and Mrs. Lisboa's paper above alluded to.

Chrysopogon.

C. Grylls, Trin. Fundam., 188.

This presents several varieties ; I have seen only the variety known as *C. glabratus*, Trin. in Mem. Ac. Petursb., *A. glabrats*, and *A. Royleanus*, Steud. Syn. Pl. Glum. 395 and 397. I received specimens from N Kanara sent by Mr. Talbot. It is reckoned to be a good fodder in Australia.

C. verticillatus, Roxb., *Fl. Ind.*, I. 263; Dalz. and Gibbs, *Bomb. Fl.* (under *Andropogon*). I have not seen this, nor do the authors of the *Bomb. Fl.* state the locality where they had found it. Roxburgh says that it is a native of mountains, flowering about the end of the wet season. Uses not known.

C. montanus, Trin, Spreng. neue Entdeck, 1193. *Andropogon monticola*, Schult; Mant. III. 665; *A. Sprengelii*, Kunth. Revis. Gram. 166.

Ver. *Tigori*, *Karni* (Duthie).

Dharwar and Mount Aboo; also in hilly parts of Northern India. On Mount Aboo it is reckoned a good fodder grass, and the grain used by the natives as food.

C. serrulatus, Trin. Mem. Ac. Petersb.; Sp. Gram., plate 331; *Andropogon Trinii.*, *A. ciliolatus*, *A. cæruleus*, Steud. Syn. Pl. Glum. 395, 396.

Ver. *Goyad*, *Ghoda* or *Ghora*, *Dand.*

This beautiful grass, especially when in flower, is common all over the Presidency in the rainy season, also in Nepal, tropical Himalaya, Kumaon, Afghanistan, Ceylon and Africa. Said to be good fodder and used in Poona, but reports from other districts are unfavourable.

C. aciculatus, Trin. Fundam 106. *Rhaphis trivictis*, Loureiro. Fl. Cochinch. 553. Trin. Sp. Gram, plates 8 and 9; *Andropogon aciculatus*, Dalz. and Gibs. *Bomb. Fl.* 303.

Roxburgh gives the following vernacular names:—*Sans*, *Shuntinee*, *Chora-pooshpee*, *Keshinee*, *Chora Kanta* (Bengali name).

Grows all over India on barren moist pasture ground; its seeds are exceedingly troublesome to those who walk where it grows; they stick in the stockings and produce a disagreeable itching. Cattle are not fond of this coarse grass (Roxb.). This grass, named *Tuteri* or *Rat-tuteri* in Ceylon, is very common there.

"There is a story told about the late Sir Emerson Tennent having come in from a walk in Kandy covered with this grass, and on asking a Modliar what it was, got in reply "only a Tutteri, Sir"! The knight mistaking the information for bad English, indignantly replied "only two or three millions!"

Heteropogon contortus and *Aristida cærulescens* are also very troublesome to sportsmen or others, who have to walk through them, as they stick in their clothes and with their rough bristles create considerable irritation. See Fergusson.

SORGHUM, Pers.

S. halapense, Pers. Syn. I. 101 ; *Holcus halapensis,* Linn. Spec, 1047 ; Roxb. *Fl. Ind.*, I., 269; Dalz. and Gibs. *Bomb. Fl.* Suppl. 99, *Andropogon halapensis,* Brot., *Fl. Lusit.* I. 89 ; Sibth. *Fl. Græca,* I. *tat.* 68.

Ver. *Bajra, Barru, Bara, Kartal, Daele, Batal.*

It is a tall grass, 2—5 ft. high or more. Nodes glabrous. Sheath compressed. Ligula ciliolate. Leaves narrow at the base, 8—12 in. long and 1 in. broad, glabrous. Panicle pyramidal, 3—4, in. to above 1 ft. long, branches numerous, dense or in some cases, loose. Hermaphrodite spikelets oblong, lanceolate, 2—3 lines long, greenish-white or pale purple coloured. First glume coriaceous, 5—7-nerved ; second glume nearly equal in length, 5-nerved, with a few hairs at the base ; third glume a little shorter, thin membranaceous ; fourth or flowering glume, small, hyaline, 2-lobed, with a fine short awn from the notch.

Pedicelate spikelet male or rarely neuter, oblong, lanceolate, nearly equal to the sessile, with a few short hairs at the base.

This grass grows all over the Deccan, Guzerat, Dhulia, and Bassein, where it is considered to be a good fodder grass for cattle. Mr. Duthie says : " Common all over Northern India in cultivated and uncultivated ground. It is considered to be a good fodder grass, both for grazing and as hay. Various reports, however, indicate its injurious effects on cattle if eaten when too young, or when the plants are stunted by drought. The same results have been observed to take place in the case of juar (*Sorghum vulgare*). Dr. Stewart was told in Hazara that cattle after eating it are often attacked by fatal head affections. In Gujranwala, Gujrat, and Shahpur districts it is said to be poisonous until the rains are over, when the cattle eat it with impunity. Tod in his " Rajasthan," Vol. II., p. 70, mentions that the seed of this grass is collected and mixed with bajra flour (*Sorghum vulgare*), and is eaten by the poorer classes in Bikanir. In Australia it is valued both for pasture and hay, and is much sought after by cattle. Native pens are made from the stems of this plant. No allusion is made regarding the injurious properties of this grass when young either in Australia or in the United States. In the latter country, where it is known as "Johnson Grass," "Cuba Grass," "Mears Grass" and "False Guinea Grass," it is highly valued, as the following extract from Dr. Vasey's "Report on the Grasses of the South," pages 16 and 17 (1887), will show :—

"Mr. N. B. Moore has cultivated this grass for 40 years and prefers it to all others, is perennial, as nutritious as any other, difficult to eradicate, will grow on ordinary soil, and yields abundantly. Horses and cattle are fond of it, both in its dry and green condition. Probably no grass gives better promise for the dry arid lands of the West. This grass is best adapted to warm climates, and has proved most valuable on warm dry soils in the Southern States. Its chief value is for hay in regions where other grasses fail on account of drought. If cut early the hay is of good quality, and several cuttings may be made in the season.

"In California it is known as Evergreen or Arabian Millet. It roots deep in the sub-soil and where that is at all alkaline, it grows enormously, but at the same time absorbs so much of the unpalatable alkali, that stock will not eat it. It is excellent for dry hills, free from alkali."

Andropogon laxus, Roxb. *Fl. Ind.* I. 271. This is probably a variety of *A.* (*Sorghum*) *halpapensis*, Brotero, with loose panicle.

Andropogon Wightii, Hack, *Andropogoneæ*, 511, is probably a variety of *A.* (*Sorghum*) *laxus* of Roxb. I have received specimens from Thana and Nassick.

S. purpureo-sericeum, Hochst. in Schimp. pl. Abyss. 1887, Rich. Tent. *Fl. Abyss.* II. 469; *Andropogon sorghum*, *Var. variegatum*, Hack, *Andropog.* 554. Culm erect, rather strong, 2—3 ft. high. Sheaths striated, compressed, glabrous, much shorter than the internodes. Nodes bearded with a tuft of long white hairs. Leaves 3—5 in. long and 2—2½ in. broad, glabrous, or with a very few short scattered hisped hairs, and with scabrous margins. Panicle ovate, 4—5 in. high. Rachis smooth, glabrous. Branches filiform, flexuose, numerous, 2 or 3 at each articulation, almost verticillate at the lowermost articulation, pedicels and articles ciliated with long rufous or purplish hairs, which cover the spikelets. First glume of the sessile spikelet thick, cartilaginous, pubescent, the margins, like the articles, with long coloured hairs. 2nd glume thick, coriaceous, nearly equal or a little longer. 3rd glume shorter, a little thinner. 4th glume smaller, hyaline, with a yellow awn about 1 in. long. Pedicellate spikelet male or neuter, linear, lanceolate, paler than the sessile, with very few short hairs at the base.

It is to be observed that the spikelets are at first whitish, but in time they become purple and ultimately brown.

Ver. *Barroo*? Almost all the sorgha are named Barroo. It is not uncommon over the various districts of the Deccan.

S. vulgare, Pers. *Synop.* I. 101; *Holcus sorghum*, Linn. Sp. 1047, Roxb. *Fl. Ind.*, 1-269; Dalz. and Gibs. *Bomb. Fl.* Suppl. 99. *Andropogon sorghum*, Brotero. *Fl. Lusit.* I. 88. *Holcus sorghum*, Roxb. *Fl. Ind.* I. 299.

Ver. *Juhndla, Juwaree, Juar, Burroo.*

It is cultivated in various districts of this Presidency chiefly in the Carnatic, Berar, where its grain is the common food of the poorer classes. It is also extensively cultivated for fodder only, the seeds being sown in close proximity to one other, when the stalk grows very tall, and is named *Karbi.*

"The stalks are extensively used as fodder, and when chopped up is known by the name of *karbi.* When specially grown for fodder purposes it is called *chari.* It is a valuable and favourite fodder for cattle, but is said to have injurious effects if eaten too young." See Duthie.

S. cernuum, Host. Gram. Austr. Plate 3, *Andropogon cernuums,* Kunth. Enum. 1. 501, *Andropogon compactus,* Brot. *Fl. Lusit.* I. 88, *Holcus cernuus*; Dalz. and Gibbs, *Bomb. Fl.* Suppl. 99.

Ver. *Shalloo, Soondia.*

Is chiefly cultivated for its grain in cold weather in some parts of the Deccan and Gujerat. In the Broach collectorate this is grown in the Deybarra and other districts under the name of *Soondia.* The stalk as a forage for cattle is unsurpassed. It contains a great deal of saccharine matter, and is thus very nutritive. Dalz. and Gibbs, *Bomb. Fl.*

"This grass is said to be found growing wild in various districts of Bombay."

S. saccharatum, Pers. Synop. 101, Nees. Pl. Afr. Austr. 86; *Holcus saccharatus*, Linn. Spec. 1047; Dalz. and Gibbs, Sypl. *Bomb. Fl.*

It is cultivated throughout Africa not so much for the sake of its grain as for sucking its sweet culm; in America for the extraction of sugar, and in Italy for making brooms, &c.

It is stated in the *Bomb. Flora* that it was introduced into Bombay under the name of "Imphee," about the year 1849, for the manufacture of sugar. It is not known whether this grass is still cultivated in this country.

Anthistiria, Linn. Fl.

A. cymbaria, Roxb. *Fl. Ind.* I. 251; Dalz. and Gibbs., *Bomb. Fl.* 304.

Ver. *Kavar, Ful-garat.*

This tall, rather coarse grass, is very common, and grows all over the presidency. Cattle eat it, and hay is made of it.

A. ciliata,* Linn. Fil. Suppl. *Pl.* 113; *A. scandens*, Roxb. *Fl. Ind.* 1·248; *A. ciliata*, Dalz. and Gibbs, *Bomb. Fl.*

Ver. *Batani, Bunden, Bungrat, Karad, Marar, Musani, Bhoru.*

This grows everywhere, and is used as a good fodder.

A. tremula, Nees, Steud. Syn. Pl. Glum. 1401.

Ver. *Bhatandi, Gandi, Bungrat* (Poona name), *Barki.*

Grows over Ghâts. Specimens received from North Kanara, and from various districts; it is said to be a good fodder.

A. heteroclita, Roxb. *Fl. Ind.* I., 249, *Andropogon heteroclitus*, Nees. *Fl.* Afr. Austr. 115, Hack. *Andropogoneæ*. Received specimens collected at Kasarsai, Poona, where it is said to be common on hilly ground, and used chiefly for roofing (thatching).

Nees and Hackel classify it (and perhaps rightly) under *Andropogon*. It is distinguished from other *Andropogons* by each receme containing 2 sessile spikelets. Roxburgh states: "This species may be immediately distinguished by its umbellets (racemes) being composed of two hermaphrodite awned florets and three male ones."

ISEILEMA, Anders.

I. Wightii, Anders. Nov. Act. Soc. Scient. 251; *Anthistiria prostata*,

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* This and the preceding are generally found together in the same field; they form the greater part of the best specimens of hay in the country.

Willd. Spec. IV, 901; *A. cimicina*, Edgew. As. Jour. 1852; p. 182. *Anthistria Wightii*. Nees, Steud. Syn. Pl. Glum. I., 400.

Ver. *Sona* or *Achigrass, Tambrut, Tambit, Gondwal.*

Grows all over the Presidency; specimens received from East Khandeish, Poona, Satara, Sholapur, Konkan and Kanara, also from Northern India.

"In Bundelkhand and Central Provinces it is frequently the prevailing grass on the black soil, its reddish coloured stems and spikelets rendering it a conspicuous object from a considerable distance." Duthie.

I. laxum, Hackel, *Andropog.*, 682; *I. prostrata*, Anders. Nov. Act. Soc. Scient.

Ver. *Shala, Gandwel, Tambit, Tambrut.*

Grows everywhere in Bombay, in Bundelkhand, Central Provinces, Patna, Pondicherry, Ceylon. In Bundelkhand this grass is abundant and largely used as fodder, and is prized above all other kinds. It is sweet-scented when fresh. Mr. Coldstream says that it is very common in Hissarbir swamps, in good land, and that where it will grow, wheat will grow. It is both grazed and stacked, and is much eaten by buffaloes. Report from East Khandeish says that its uses are not known there; from Poona that it is not much valued, used for grazing when young.

The two grasses are similar, but *I. Wightii* is more diffuse and generally quite prostrate. The clusters of its spikelets are smaller and usually more excerted from the bracts; and the keel and edges of the bracts are papilose. Both these grasses are common near the Yeroda jail and other parts of Poona.

I believe that one or two more species of *Issilema* are growing in this Presidency. They require an examination.

APLUDA, *Linn. Gen. Pl.*

A. aristata, Linn. Amæn, Ac. IV. 303. Lin. Ill. gen. Plate. 841, Fig. 2; *A. Gryllus*, Beauv, Agrost. 23. Fig. 5.

Ver. *Phulse, Tulsi, Paodi, Khavas, Bhickma, Kharwel, Tambiti, Chickwar, Thambat, Kurdia, Pokilia, Pockli, Phulaer, Bhas, Makkhá.*

Botanists have described several varieties, such as (1) *A. microstachya*, Nees, Pl. Meyn. 193. (2) *A. communis*, Nees. l. c. 194; *A. villosa* which is *A. aristata* of Roxb. *Fl. Ind.* I. 326, (3) *A. rostrata,* Nees l.c. 194, (4) *A. ciliata,* Anders. Hack, *Andropog.* 200.

All these varieties grow in India, and the above vernacular names are applicable to all of them. The leaves of *A. rostrata* are petioled, the petiole of *A. communis* is short. This grass in hedges and bushy places becomes elongated, and assumes a climbing habit. Said to be a good fodder in some places. It is eaten only when young and green.

Report from Poona says :—" Good fodder for buffaloes when young, but it easily breaks down when tall, hence not fit for cutting and stacking."

NOTES ON A RARE FUNGUS FOUND GROWING ON THE DRUMSTICK TREE.

By Surgeon Major K. R. Kirtikar, I.M.D.

(*With a plate.*)

Read before the Bombay Natural History Society on 29th June 1891.

In December, 1887, I came across a recently cut stump of the Drumstick tree—*Moringa pterygosperma,*—at the foot of the Worli Hill in Bombay. The fungus, pictured in the plate accompanying this note, was found growing all along the cambium layer of the main stem. It was in large masses grouped all round the woody tissue but not growing from it nor sending its mycelium along the loose cellular tissue of the porous medullary rays. The mycelium appeared to be chiefly scattered over the recently cut cambium layer thickly covered over with the gummy exudation so often seen on the bark and fresh cut surfaces of the plant. I have seen several fungi of this "*Pleurotus*" sub-division growing on the dead bark of *Moringa pterygosperma* many a time since, but I have not yet come across another specimen which has had all the characteristics I observed in the particular specimen I am now describing. It appears to me to be a distinct species in itself. If I were to give it a name—and indeed a name is required as it is a fungus neither discovered nor described before—I should call it *Agaricus* (*Pleurotus*) *moringanus*; *i. e.*, *moringanus* growing on *Moringa pterygosperma*, and partaking of its odour.

DESCRIPTION.

Pileus.—Covered with fine down when young. Smooth when full-grown; partly membranaceous, partly spongy, especially in the centre; revolute, cream-coloured, varying from one inch to three inches in length, ½ to 4 inches in breadth; ¼ inch in thickness. Veil evanescent, very finely fibrillar when young; disappearing very early. Ring absent.

Stem.—¼ to one inch long, lateral, confluent and homogeneous with the hymenophore, cream-coloured; membranaceous, spongy in the centre, often repand. *Margin* entire in young specimens, deeply curved forward; in full grown specimens, deeply involute, sinuate, and cracked.

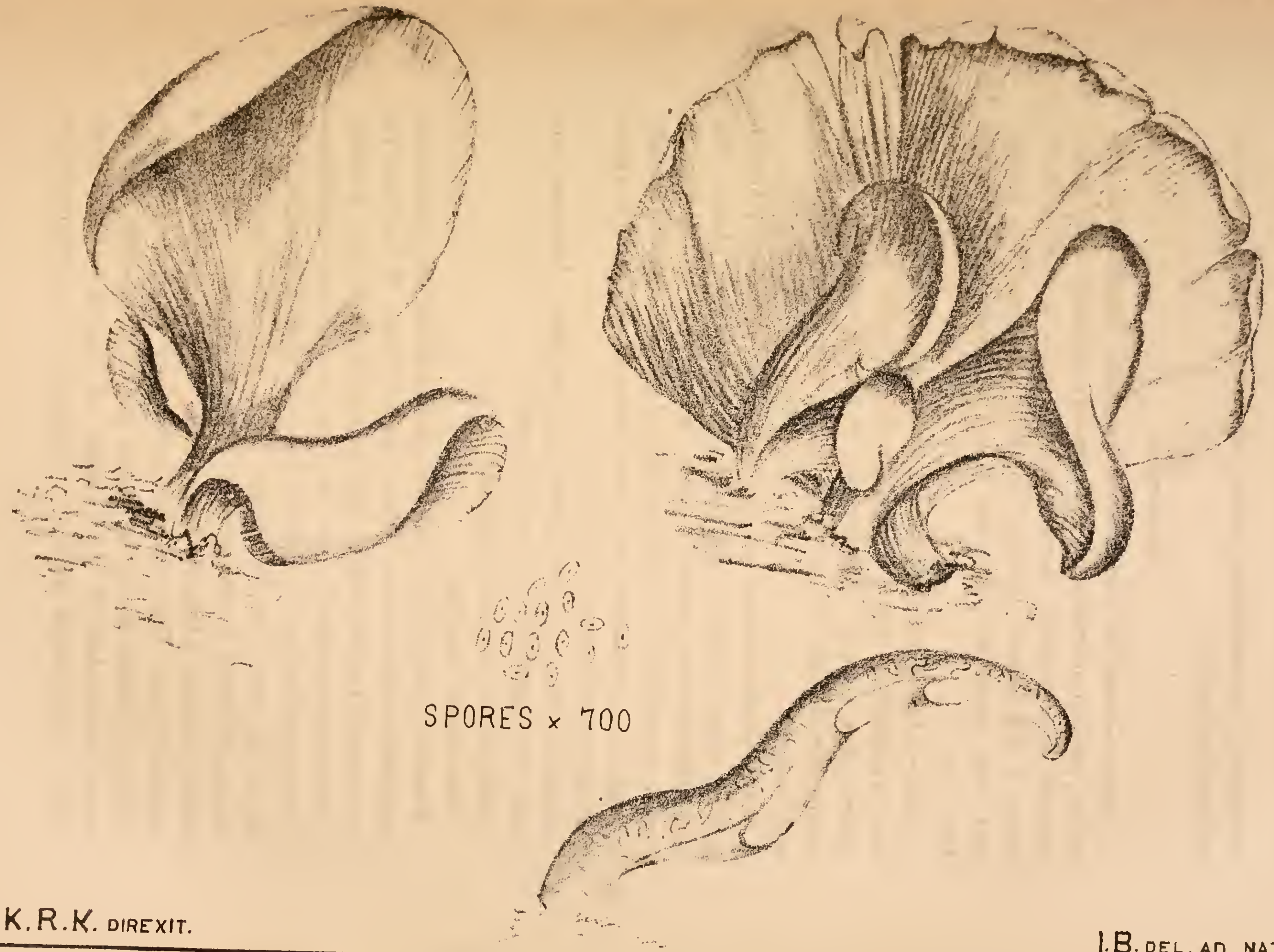
Gills.—Cream-coloured; of two kinds, long and short; breadth ¼ inch; rather crowded, with tough trama of a spongy kind. The long gills decurrent, gradually lost in the substance of the stem all the way down; the short gills, broadly and distinctly rounded behind, and quite in contrast with the other known species of this Agaric growing on the *Moringa* or elsewhere.

Habitat.—Growing direct from the cambium layer. Mycelium firm white. The habit of the fungus is cæspitose.

Spores ·003 × ·007 m.m., elliptical.

Odour that of the plant.

Remarks.—The points of interest connected with this species are chiefly with reference to its habitat and its odour. I have not yet come across a fungus growing from the cambium layer and so quickly, for it appeared that the tree had been cut down the day previous. It is very seldom that a parasitic fungus partakes of the odour peculiar to its host. The Drumstick tree is a familiar figure in the Konkan fields and kitchen gardens. It is largely cultivated for its twisted trilateral follicles wrongly called "pods," which contain a rich fleshy pulp. This pulp when cooked with butter, salt and pepper yields an agreeable and by no means unwholesome dish. Its root is used in the place of Horse-raddish at English tables in India. Though a little coarse in fibre, the scrapings of the root are quite as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AGARICUS (PLEUROTUS) MORINGANUS

good a substitute as one could expect to have in point of flavour and pungency. The flavour and pungency are due to an essential oil which is abundant in the loose parenchyma of the bark of the *Moringa*. The soft and porous woody tissue also contains this essential oil. No wonder then that any parasite throwing its mycelium on its most vitally active cells should imbibe the essential oil and retain it in its own tissue.

The odour of this fungus seems attractive to a certain kind of insect. It is a small weevil of the size of a pea. I hope to investigate this on a future occasion, as I find that it commonly infests the *Moringa* and burrows into its bark, cambium layer and even wood. This weevil attacked the whole specimen I am describing within two days after I had collected it, chiefly destroying the inner spongy tissue and leaving the bare "epidermis" of the pileus if I may so term it. The major portion of my fungus was thus destroyed. The chief point for congratulation is that following the principle of "striking while the iron is hot," a principle always well worth following in the study and sketching of fungi, I had Mr. Isaac Benjamin—my gifted artistic friend who has always been an invaluable prime aid to me in all my botanical sketches—to draw the fungus on stone on the spot, the very day I observed it.

The question strikes one as to whether this peculiar horse-raddish odour has an attraction for the weevil that destroyed my fungus, for we find that it certainly, I ought to say presumably on account of that odour, attacks the host, even in the living state of the latter. Everybody who knows the habit of the *Moringa pterygosperma* can call back to memory the gum-studded stem of this tree marked with burrows and furrows clogged with the millet-seed sized globules of the weevils' excreta bound up in innumerable chains with flocculent fibres not unlike a cobweb. Does this weevil find any special charm in the odour which the fungus inherited from the *Moringa*?

Mr. M. C. Cooke—that indefatigable veteran mycologist of England who has kept British mycology abreast of the most advanced mycology of Europe, in writing in a recent number of his Grevillea (December, 1890), on the attractive odours in fungi—mentions that the well-known fungus called *Russella fotans* seems to be attractive to slugs, since it is usually found more or less eaten by them.

"Has odour any attraction?" he asks. There are other odorous fungi, however, Mr. Cooke says, "Such as the *Agaricus odorus* and *Agaricus fragrans* which are not attacked by slugs." There is a species of *Agaricus campestris*, which I have gathered in Thana for several monsoons past which smells strongly of aniseed oil, but which, however, is not liable to the destructive attacks of insects or small filiform slugs any more quickly than the inodorous *Agaricus campestris* gathered in almost its immediate neighbourhood. The point is worthy of investigation, and I commend it to the careful study not only of those who are interested in the study of fungi, but also of those who watch the habits of the insects and molluscs which destroy our plant life.

ON THE GAUR (BOS GAURUS) AND ITS ALLIES.

By W. T. Blanford, F.R.S., F.Z.S.

(*From the Proceedings of the Zoological Society of London, page 592, 1890.*)

Very little has been added to our knowledge of the classification, habits, and distribution of the wild Indian *Bovidæ* since Blyth, thirty years ago, wrote an excellent account of the "flat-horned taurine cattle of India."[*] But an important addition to the opportunities hitherto afforded to residents in London of studying the living animals of this section of the genus *Bos* has been made by the arrival at the Society's Gardens of a young male 'Gaur' or 'Sladang,' *Bos gaurus*, in the autumn of 1889.[†] Despite many previous attempts to introduce this animal, no other individual is known to have reached Europe alive. Examples of both the other species beloning to the same section have lived in the Gardens.

The young animal[‡] now in the Gardens at Regent's Park was one of a herd of twenty-four animals captured by the Sultan of Pahang in the Malay Peninsula, as described by Mr. A. H. Wall, in the 'Field' (June 1st, 1889, p. 767). A stockade or kraal, similar in form to that used for capturing elephants, was constructed on a promontory, covered with high grass and bushes, on the Pahang river, and the herd of Gaur were driven into the enclosure by about 1,500 beaters. The frightened animals charged and fought each other until one-half were killed or mortally wounded, the survivors were driven into a long narrow passage leading to the river and isolated from each other by bamboo poles.

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[*] J. A. S. B., XXIX., p. 282 (1860). The substance of this paper was subsequently republished with additions in a series of articles on "Wild types, and sources of Domestic Animals" that appeared in 'Land and Water,' Vol. iii, 1867, pp. 287, 345, 395, 422, 476, 630.

[†] See P. Z. S., 1889, p. 447.

[‡] This animal is now (Nov., 1890) in excellent health and condition, and has grown to nearly his full stature.

The section of the genus *Bos* comprising *Bos gaurus* and its allies was separated by Hodgson* under the name of *Bibos* in 1837. It comprises three well-marked forms, and is distinguished by the horns being flattened or sub-elliptical in section, especially towards the base, by the tail being short, only reaching the hocks, and by the spinous processes of the dorsal vertebræ being long and those of the lumbra vertebræ short, the change in length taking place abruptly, so that there is along the anterior half of the back, from the shoulders, a high ridge which terminates suddenly about halfway down the trunk. This character, however, is less marked in *Bos sondaicus* than in the other two species, and the flattening of the horns is less conspicuous in females than in males, and is sometimes not to be detected in cows of the species just named.

All the species have a peculiar and characteristic coloration, the old males being dark brown or almost black, the females and younger males, paler or reddish-brown, the legs from just above the knee and hocks downwards white or whitish.

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* J. A. S. B., vi., p. 747; see also J. A. S. B., p. 447, and xvi., p. 706. Blyth, in his 'Catalogue of the Mammalia in the Museum of the Asiatic Society,' 1863, p. 160, adopted the generic term *Gavæus*, Hamilton Smith. In this he was followed by Jerdon (Mammals of India, p. 301). I cannot find any publication of the name *Gavæus* as a generic term by Hamilton Smith. In Griffith's 'Cuvier,' iv., p. 406, and v., p. 375, the Gayal is described under the name of *Bos gavæus*, and placed in the sub-genus *Bison*. Hodgson subsequently, in 1847 (J. A. S. B., xxi., p. 705), separated the Gayal from *Bibos*, and made it the type of a distinct genus *Gavæus*, and both genera were admitted in Horsfield's 'Catalogue of the Mammalia in the Museum of the Hon. East India Company.'

The three known forms may be thus distinguished :—

A. No white caudal disk; dorsal ridge high. Females dark umber or sepia-brown.

- *a*. Forehead very concave; a high ridge, the upper border of which is very convex, between the horns. Horns curving much, the points turned inwards. *Bos gaurus* (the Gaur).
- *b*. Forehead nearly flat, no elevated ridge between the horns. Horns curving but little, points not turned inwards. *Bos frontalis* (the Gayal or Mithan).

B. A white caudal disk. Females reddish-brown approaching chestnut. Dorsal ridge much lower, termination inconspicuous. Forehead narrower and skull longer than in the other species Horns smaller and more curved than in either, the points turned in. *Bos Sondaicus* (the Banteng).

Coloured figures of the Gayal have already appeared in the Society's Proceedings' (♂, 1866, pl. i., ♀ and young, 1882, pl. x., p. 233). Excellent coloured representations of the Banteng are to be found in Sal Müller and Schlegel's 'Verhandelingen Nat. Gesch. Ned. overz. Bez.' The accompanying figure* (Plate XLIX.) of the young male of *Bos gaurus*, now in the Gardens, is probably the first taken from a living example, though many figures have been given in illustration of Indian sporting and Zoological works.† Not one of these, however, appears to me to be a really good representation of the animal, and I am doubtful whether the portrait of the young tame bull now published will convey a correct idea of an adult Gaur in his native haunts. The photograph of a dead Gaur (apparently a bull just mature), which I now exhibit (see woodcut, p. 594), affords a better conception of the animal than any drawing I have ever seen‡.

A figure of the bull Gayal (*Bos frontalis*), which serves to shew the proportions, and to some extent the differences of the type, is given in another photograph, kindly lent to me for the purpose by Dr. J. Anderson, who had the original in his possession in Calcutta. It was a superb specimen, and was intended for the Society's Gardens, but unfortunately met with an accident, from the result of which it died, when being shipped for England. The shorter legs, large dewlap, shorter head, and differently formed horns are shown in the photograph (see fig. 2).

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* This figure is copied from photographs taken in the Gardens by Major J. Fortune Nott, F.Z.S., who has very kindly allowed them to be used for the Plate.

† The most spirited and artistic is that by Wolf in Col. Walter Campbell's 'My Indian Journal,' but it is incorrect in several points. Figures of it are given in Forsyth's 'Highlands of Central India,' Sanderson's 'Thirteen years among the Wild Beasts of India,' Sterndale's 'Seonee,' the same author's 'Natural History of the Mammalia of India and Ceylon,' and Hornaday's 'Two years in the Jungle.'

‡ I am indebted for the loan of this photograph to Dr. V. Ball, C.B., and Mr. A. B. Wynne. I regret to say that the original photographer is not known.

I cannot concur in the view taken by Hodgson, Gray, Blyth, and Horsfield that there is a difference amounting to generic distinction between this group of flat-horned bovines and typical *Bos*, e. g., *B. taurus* and *B. indicus :* indeed I feel grave doubts as to the generic distinction of the Bisons and Buffaloes from the taurine cattle. *Bos sondaicus* is in some respects intermediate between *Bos gaurus* and the typical forms, whilst the distinctions between *Bos caffer* and *Bos bubalus,* or between *Bos bonassus* and *Bos grunniens,* appear very similar in kind to those between *Bos taurus, Bos bonassus,* and *Bos bubalus,* and not very different in degree. But if the genus *Bos* be divided, the most natural sections appear to be the taurine, bisontine, and bubaline; and the members of the flat-horned section agree far better, as has been, I think, shown by Lydekker in his discussion of the fossil forms, with the taurine than with the bisontine subdivision, although they were referred to the latter by Hamilton Smith and others.

Our present knowledge of the range of the three species of this section of *Bos* may be thus summarized :—

Bos gaurus.—The Gaur is found in all the larger forest-tracts of the Indian Peninsula from the Ganges to Cape Comorin, but not in Ceylon. Its extreme north-western range, at present, I believe, to be in the neighbourhood of the river Nerbudda, east of Broach, and west of long. 80° E. the valley of the Nerbudda forms approximately its northern limit, though it may in places exist a little further north. It does not inhabit the grass-jungles of the great Indus and Ganges plain, except to the eastward in the neighbourhood of the Himalayas ; in fact this animal is seldom, if ever, found far away from hilly ground. It occurs in the forests along the base of the Himalayas as far west as Nepal, and is met with in the hill-regions south of Assam, and thence in all suitable localities throughout Burma and the other countries immediately east of the Bay of Bengal down to the southern extremity of the Malay Peninsula where its occurrence is no new discovery, for Blyth recorded its existence there in the paper already quoted.* The range of the Gaur in Siam, Cochin China, Tonquin, &c., does not appear to have been ascertained with any certainty; it is said to occur in Siam, but I can find no record of its occurrence further east, and no mention of the existence of any flat-horned bovine in South China is made by Swinhoe.

The Gaur is unknown in the Malay Islands and in Ceylon, but the statement has repeatedly been made that it formerly inhabited the latter. I am disposed to think this doubtful, and I quite agree with Sanderson† in my surprise that the Gaur should have disappeared from a region where wild Elephants are still found in large numbers. Throughout the Peninsula of India the reverse is the case; the Elephant has, I think, clearly been the first to disappear, as in the Satpuras, the Northern Syhadri, and throughout parts of Chutia Nagpur, where the Gaur still occurs. A belief in the former occurrence of *Bos gaurus* in Ceylon is partly founded on the fact that Knox, writing in 1681, mentioned under the name of *Guavera*, an animal kept tame at Kandy, and partly on Kelaart's statement‡ that "the Kandyans also say that the *Goura* once roamed through those forests which to the present day are called after the Goura—Goure-Ellia, Goura-Koodie, &c." On the other hand, it is by no means improbable that the Gaur, like the Tiger, never inhabited Ceylon, a circumstance very possibly due to the animal not having migrated into Southern India until after Ceylon had been separated by sea.

Bos sondaicus.—The Banteng is entirely confined to countries east of the Bay of Bengal. The northermost localities from which it has been distinctly recorded are Northern Pegu and Arrakan west of Pegu; but Blyth has shown (J. A. S. B., XXIX., p. 294) that it probably occurs in the ranges east of Chittagong. It is common in Tenasserim, and is probably found in Siam, the Malay Peninsula, and Sumatra. It occurs in Java, Bali, and Borneo, and besides the wild animals large herds exist in Java and perhaps in Sumatra in a domesticated state.

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* Cantor too, in 1846, stated that the Gaur was "numerous in the Malayan Peninsula." (J. A. S. B., xv., p. 273).

† 'Thirteen years among the Wild Beasts of India,' p. 243.

‡ Prodromus Faun. Zeyl., p. 87. In Griffith's 'Cuvier, v., p. 410, too, it is stated that the wild ox or Guavera of Ceylon was shot by British parties during the war with Kandy. But the animals shot may have been Wild Buffaloes.

Bos frontalis.—I have left this to the last, as the question of the range and even of the existence of the wild animal is disputed. The Gayal or Mithan is kept tame by the hill-tribes on both sides of Assam valley and throughout the Chittagong hills as far south as the neighbourhood of Akyab in Arrakan. According to the earlier accounts, both wild and tame animals are found in the hill-ranges south of Assam; and an elaborate account was given in the Linnean Transactions, Vol. VII., p. 303, by Mr. Macrae (quoted by Mr. Lambert) of the manner in which the Kukis captured the wild herds by the help of the tame Gayals. It is quite possible that this story may have been devised by the inventive faculty of Mr. Macrae's informant, though the account in itself has more innate probability than most of the legends about animals that we owe to the imagination of the natives of India, whether civilized or not. Some recent writers, and especially Mr. J. Sarbo* who writes apparently with good opportunities for knowing, declare that there is no such animal as a wild *Bos frontalis* known, at all events in the country extending from Assam to Arrakan. Blyth too,† only notices the wild race as numerous in the Mishmi hills and other hill-ranges bordering on Upper Assam, and states that it is the domestic race that extends southward to near Akyab.

It has even been suggested (though certainly not by Mr. Sarbo, who clearly appreciates the distinction between the two) that *Bos frontalis* is a domestic race of *Bos gaurus*. This is not impossible, but at the same time it is not, I think, a probable view, because if it were the case, as both animals inhabit the same forests, and as the tame herds of *Bos frontalis* are said to roam freely during the day, merely returning at night to their owner's village, the two would assuredly interbreed; and it is incredible that the difference between *Bos gaurus* and *Bos frontalis* should be so constant as it is, and so very much more marked than in the case of the wild and tame Buffalo, although the range of the tame animal in the latter case is very far from coinciding with that of the wild race. Hybrids between *Bos frontalis* and the humped cattle *B. indicus* are said to be common; but the skulls of *B. frontalis* brought from localities as far apart as Upper Assam and the Chittagong hills appear, so far as can be judged from the accounts given, to be similar to each other, and to be all similarly distinguished from those of *B. gaurus*. Further information on this point is desirable; but as to the absolute distinction of the two and the absence of intermediate forms we have the important testimony of so good and trustworthy an observer as Mr. S. E. Peal.*

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* P. Z. S. 1883, p. 143.

† Cat. Mamm. Mus. As. Soc., 1863, p. 162.

There are two facts that should be borne in mind in any endeavour to disentangle the somewhat complicated history of *Bos frontalis*.

1. The names of animals used by various nations and tribes are just as carelessly and loosely applied as English terms are employed by English-speaking people. In America the English term selected for the Bison is the name of that particular bovine to which perhaps the Bison is least related and which it least resembles—the Buffalo—whilst in India the common English name for *Bos gaurus* is Bison. It is not therefore surprising that terms like Gaur and Gayal are interchangeable. In fact, in a number of Indian languages, the name applied to *Bos gaurus* means wild buffalo.† I have myself heard the name Gayal used for *Bos gaurus* in Orissa, where *Bos frontalis* is unknown. Probably the same name Gayal is used by such inhabitants of Tipperah, Chittagong, &c., as speak Hindi or Bengali (foreign languages to the majority) indifferently for *Bos gaurus* and *Bos frontalis*. Mr. Peal states that in Upper Assam both are known as Mithan. It is easy to understand the confusion that may thus have been caused to naturalists of a generation or two back, who appear, judging by their writings, to have regarded such names as restricted to particular species.

2. Blyth has given at length‡ some very curious evidence obtained by him, which, if correct, certainly appears to show that

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* *Nature*, Nov. 5th, 1885, Vol. XXXIII., p. 7.

† *Ran-hila, Ran-pada* in Mahratti and Guzuratti, and *Jangli Khulga* as quoted by Jerdon. I have even heard the name *Arna*, the correct appellation of a wild buffalo, applied to *Bos gaurus*.

‡ J. A. S. B., xxix., p. 294; see also Cat. Mamm. Mus. As. Soc., p. 162, *Gavæus gaurus*, specimen D.

Bos gaurus itself is domesticated by some of the hill-tribes in the Tipperah hills. If this were substantiated, it might account for the descriptions by Mr. Macrae of the taming of the wild 'Gayals' by the Kukis, the Gayals in question being *Bos gaurus*. As I have already stated, Mr. Macrae's story has a distinct appearance of truth.

I think it highly probable that Mr. Sarbo is right in his opinion that *Bos frontalis* does not exist wild south of Assam. It is true that we know very little of the great hill-area south of Manipur between the Kyendwen river and its tributaries to the east, and Tipperah, Chittagong, Arrakan, etc., to the west. But it is scarcely probable that three wild forms so nearly allied as *Bos gaurus*, *Bos frontalis*, and *Bos sondaicus* should be found living wild in the same area. It is far from improbable that *Bos sondaicus* is the representative in comparatively level country of the hill-loving *Bos gaurus*, and that the two do not actually inhabit the same tract, but both *Bos gaurus* and *Bos frontalis* are distinctly inhabitants of hill-forests and are splendid climbers.* It is more probable that these two are representative species inhabiting distinct areas. *Bos frontalis* may be the wild ox of the Mishmi hills and of the mountains extending eastwards from Assam. These hills have scarcely been penetrated by any Europeans, and are extremely difficult of access. In some MS. notes, for which I am indebted to Mr. Hume, he gives measurements of the horns on a skull, which was sent to him as that of a wild animal from the South Mishmi hills. The measurements are those, I think, of *Bos frontalis*, the tips of the horns being 37 inches apart.

There is one more point on which a remark is necessary. The animal described briefly by Mr. Davison,† as the 'Sapio' of the Malays may be *Bos sondaicus*. It is not impossible that the white of the 'stockings' may be rufous in some individuals of either *Bos gaurus* or *Bos sondaicus* (I have seen them deep yellow in a bull *Bos frontalis*).* The insides of the legs are not unfrequently of a golden-brown and may occasionally be chestnut. It seems hardly probable that an additional species besides *Bos gaurus* and *Bos sondaicus* remains to be discovered in the Malay Peninsula.

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* To the powers of *Bos gaurus* in this respect I can speak from personal observation. I have seen them go at speed down slopes where I could only follow by holding on to the bamboos and shrubs, and all observers have remarked on the climbing propensities of *Bos frontalis*. *Bos sondaicus* is, as Blyth points out, a more leggy animal than its two allies, and I think *B. gaurus* has proportionally longer legs than *B. frontalis*.

† P. Z. S., 1889, p. 448. It is worthy of notice that Cantor (J. A. S. B., xv., p. 272) in his Catalogue of the Mammalia inhabiting the Malayan Peninsula and islands, does not mention *Bos sondaicus*, and gives Saki utan (which means, I believe, simple wild cattle) as the Malay name of *Bos gaurus*.

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* Since the above was written, I have seen the bull Gayal in the Society's Gardens, with a distinctly ferruginous tinge on parts of his white 'stockings.' I can well believe that all the lower parts of each leg may be stained red in some animals. The coloration is due, Mr. Bartlet tells me, to an exudation, that becomes much more copious in hot weather.

AGRICULTURAL ENTOMOLOGY.

(*Being a Lecture delivered by* E. C. Cotes *before the Agri-Horticultural Society, Calcutta, on* 19*th March*, 1891.)

Five years ago it would have been a simple matter to give a lecture on the agricultural entomology of India, for at that time so little had been ascertained about either the insects which injure crops to any serious extent, in this part of the world, or about those which are useful to man, that a short account of what was known of the whole of them might have been included in a single lecture. Now, however, the case is very different; for, owing to the system of collecting information which has been pursued of late, such a large amount of material has accumulated, that the only difficulty has been to pick out what should be sufficient to give some slight idea of the subject, and yet be such as could be gone through within the hour.

Magic lantern illustrations seemed likely to make it easier to explain about the insects, so it was decided, in the first place, only to tell you about those of which I have lantern slides. This restriction, however, still left a very much larger field than could possibly be dealt with, so it was further decided only to touch upon such of the insects as had been injurious to crops during the past year, and to leave out all mention of the silkworms and other useful insects which have also been under investigation. Even then a good deal more material remained than could be dealt with, so I propose only to touch upon the better known and more important species, and to omit altogether a very considerable number of different kinds of insects which have been sent to the Indian Museum during the past year as injurious to crops, but which, so far as our information at present goes, are of lesser importance.

The locusts which have over-run nearly the whole of India during the past two years, and whose life-history has lately been traced, are perhaps the most prominent of the insects which I have to show to you to-night. But as a diagram is in preparation to explain what has been found out about the locusts, I will to some extent reverse what would otherwise be the natural order of things, and take the other insects first, leaving the locust to be shown to you at the end if time allows.

The first slide, then, which I have to show to you to-night is a photograph of the moth *Leucania extranea,* which I reared from a caterpillar sent by the Collector of Rungpur, where the insect was very destructive to paddy in the early part of the past cold weather; the Manager of the Wards' Estates, Rungpur, indeed reporting that many of the cultivators had been ruined by it. The caterpillars live in holes in paddy fields where the water has subsided, and sally out at night to cut off the unripe ears of paddy, which they drag to their holes in the ground where they devour them at their leisure. This is all that has yet been actually observed in India about the insect, but comparative examination of it shows that it belongs to that section of the zoological group of *Noctucs* moths, whose caterpillars are known in the United States as cut-worms; and the habits of such a number of forms belonging to this group have been so closely observed in other parts of the world, and have proved so constant for the different forms, that we can predict with almost absolute certainty that those of the present insect are as follows. The mother moth, after meeting with a mate, lays her eggs on plants, and the young caterpillars, which are born from these eggs descend into the ground, and burrow for themselves holes where they live until they arrive at their full growth. They then molt their skin and become little brown chrysalids. The chrysalid lies in the ground until the moth is ready to emerge, when the skin cracks down the back, and out of the dried-up chrysalid's case creeps a soft fluffy moth which crawls out of the burrow and spreads its wings to dry in the air, as a preliminary to taking flight and starting a family of its own. The whole of the life of the insect, from the time it is laid as an egg by its mother to the time when it lays eggs of its own, only occupies a few weeks, so that several generations are gone through in the course of the year. But it is only for a short time of the year that the paddy fields are a suitable dwelling place for this insect. For we know that throughout the whole of the rains the paddy stands in water, so it would be quite impossible for the caterpillar to burrow into the ground, and if it remained on the paddy plants during the day time it would be almost certain to get eaten up by the birds, which are very fond of it. It is only the autumn generations of caterpillars that can feed on rice, and the spring and summer generations must live on some other plant. If, therefore, we could destroy the plants upon which the spring and summer generations feed, we should get rid of the pest altogether, for there would then be no moths to lay their eggs upon the rice plants in the autumn. The first thing to do is, of course, to find out upon what plants the caterpillar feeds. The only other upon which the insect has yet been observed to feed is the oat plant, but there is every probability that it feeds upon a number of grasses. Now in Bengal, we know that during the greater part of the rains almost the only grasses which are not submerged are those which grow upon the bunds between the paddy fields, and there is thus very considerable probability that if the bunds were kept clear of all rank grass during the rains, there would be no moths to lay their eggs upon the rice plants in the autumn. In fact, we shall see that, when practicable, it is a good thing to keep the rice bunds as clear as possible all the year round, for another very destructive paddy pest, the paddy borer, about which I will tell you presently, is also propagated in the rank grasses which spring up around the rice fields. With regard to other means of dealing with the paddy cut-worm, a number of suggestions have been made, but for the most part they are only applicable to crops which are more elaborately cultivated than rice, and with which therefore more costly treatment is practicable.

We have spent so long over the paddy cut-worm that I must hurry over the remainder of the insects belonging to this group, and will only notice that in Oudh last cold weather the young *rabi* crops, including opium, suffered severely from cut-worms belonging to the species *Ochropleura flammatra* and *Agrotis suffusa*, which I now show to you. The only remedy found effective was irrigation, which brought the caterpillars to the surface, so that the birds could get at them. In Maisur, also, during the past few months, young coffee has suffered badly from cut-worms, one of which we have reared in the Museum, and found to belong to the cosmopolitan species, *Agrotis segetum*, which now appears upon the screen. This insect was in such numbers that it destroyed fifteen thousand fine young coffee plants on a single estate, in spite of the fact that the manager put on all the coolies to collect the caterpillars by hand, with the result that considerably over a lakh of them were destroyed.

From the Murshidabad, Tipperah, and Jalpaiguri districts also come accounts of injury to young *rabi* crops by cut-worms. The produce indeed of two thousand bigahs of land in Murshidabad is said to have been destroyed by them last cold weather. Enough, however, has already been said to give you some idea of the nature of the pest.

The next slide which we come to shows a caterpillar of the paddy borer, with a bit of rice straw which has been tunnelled by it. This insect is reported to have done considerable injury during the past two years to paddy in the Thana district of Bombay. It was previously described in a paper by Mr. Wray as destructive to paddy in Perak. The insect tunnels the rice straws, thereby lowering the vitality of the plant and spoiling the crop. I have not as yet been successful in rearing the moth of this insect in the Museum, but the caterpillar is so closely allied to the rice stalk borer of the United States, that we are quite safe in concluding that the two insects have identical habits. These habits are as follows: The eggs are laid in batches at the base of the leaves, some hundreds of eggs being sometimes laid by one female. The caterpillars hatch rapidly, and after feeding for a short time upon the leaves they tunnel into the stalk, the chrysalis being formed either in the leaf sheaths or stalks. Several generations, each of which takes about two months, are gone through in the year. Two or three of these generations take place between the reaping of the rice of one year and the springing up of the succeeding crop in the next year. These intermediate generations are said to be passed in the self-sown rice and big grasses which spring up in and around the rice fields. In this pest therefore we find an additional reason for encouraging the keeping down of the growth of rank grasses around rice fields.

The next slide is intended to represent the various phases in the history of the maize borer, which has been sent to me, by the Secretary to the Municipal Committee, Amritsar, as responsible for the destruction of what has been variously estimated at one-sixth to one-tenth of the maize and millet crops around Amritsar last year. This insect is, so far as we at present know, the same as the one which is so often destructive to sugarcane. It damages the stalks by drilling holes in them, the result being that moisture finds its way into the stalk and sets up putrefaction, which in the case of both sugarcane and sorghum, is of a particularly offensive nature. The insect is referred to by Duthie and Fuller, in their admirable work on field and garden crops, under the name of *salai* or *silai* when it attacks maize and sugarcane, and under the name of *bhaunri* when it attacks sorghum. In the case of sorghum the morbid putrefaction which it sets up in the stalks is said to render the plant poisonous to cattle. The moth lays its eggs at the base of the leaf sheaths and the larvæ tunnel into the stalks, where the chrysalids are also found. Several generations are gone through in the warmer months of the year ; and the insect passes the cold weather in the caterpillar stage in a dormant condition in its burrow in the stalk. Old cane stalks therefore are the most fruitful source of the spreading of the pest, and anything that tends to keep the old stalks away from the growing crop must likewise tend to reduce the evil. This insect attacks sugarcane in all parts of the world, and very numerous remedies have been tried with a greater or less measure of success. But the only measure which seems to be universally recommended is that of keeping the fields clear of all old stalks and cane trash, in which the insect would otherwise find shelter. It may be noticed that this insect occurs chiefly in dry seasons, and that some varieties of cane are more subject to it than others. The explanation which has been offered of this fact is that in cases when the cane is growing vigorously the insect gets suffocated by the juice which accumulates in its burrow, so that it is only when the flow of juice is not very vigorous that the insect survives. This therefore points to the utility of irrigation for fields that are attacked, and explains the fact that in fields which are kept clean and are well cultivated the insect does much less damage than in fields which are cultivated in a slovenly manner. This feature is of very wide application in connection with boring insects of all kinds, and it explains some very curious points in connection with insects that bore into wood, notably with the bamboo borer and the sal girder, about these I will tell you at the end of the lecture, if time allows, in illustration of the fact that, at least in the case of boring insects of all kinds, healthy plants not only recover much more rapidly when they have been attacked than unhealthy ones, but are actually much less liable to be attacked in the first instance. Talking of the causes which tend to keep down this pest, I should naturally pass to the parasites which are sometimes so effective in destroying it, that they entirely defeated the attempts which I made some time ago to rear the moth from sorghum shoots. I must go on, however, to the next insects, as we shall otherwise not get through our programme within the hour.

The next slide is a photograph of a few of the apple twigs, which have been sent to me in connection with the great injury which has been done during the past two years to apple trees in the Nilgiri Hills by a minute insect which proves to be *Schizoneura lanigera*, the *American blight* of Europe and the United States. The slide shows the characteristic gall-like growth, which arises both on the branches and roots, from the irritation set up by the insect in feeding upon the juice of the tree, also the fluff-like secretion which serves to protect the insects themselves. For *Schizoneura lanigera*, unlike most other aphids, has not entered into any defensive league with the ants. The habits of this insect have been observed by Lichtenstein, who found that the winged individuals, like the one which you see on the slide now before you, beget in the autumn the wingless male and female, which do not take any nourishment, and whose only function it is to produce the winter egg. Each female lays but one winter egg, and then dies. The winter egg lies through the winter upon the bark, and hatches in the spring into a little wingless creature like the one in the slide now before you. This minute insect sticks its proboscis into the bark and begins feeding on the juice. It grows rapidly, and after molting its skin several times, it lays a number of eggs, each of which develops into a little wingless creature like its mother. These second generations of so-called females have exactly the same habits as their mother, and soon lay a large number of eggs. This process goes on all through the warmer portion of the year, innumerable multitudes of the little wingless females being in this way 'produced and the result is that a tree which is once attacked rapidly becomes infested. These little wingless females crawl all over the branches and roots, and wherever they settle they raise the characteristic galls which I have just shown to you, so that the whole tree becomes knotted and distorted and weakened to such an extent that it is quite incapable of bearing fruit. All through the summer the insect, not possessing wings, is only able to crawl slowly along, and does not spread to any great distance except when carried by accidental agencies, such as birds or high wind, from one tree to another. With the first cold of autumn, however, the eggs of the little wingless females produce winged females which fly from tree to tree, and thus carry infection to considerable distances. They then settle down and produce the wingless males and females by which the winter eggs are produced. With regard to remedies for this insect, spraying and washing affected trees with kerosine emulsions and caustic washes has been found to a certain extent successful, and when properly applied these washes undoubtedly kill the insect wherever they touch it. Though the difficulty in getting at the roots and crevices between the branches is so great that many people are of opinion that once a tree is affected the best thing is to cut it down and burn it to prevent its becoming a centre of infection, On the whole, however, there is every reason to hope that as the insect is only able to fly for a short time in the year, much may be done by planting lines of trees to serve as wind breaks and prevent the blight from being carried from one orchard to another, and also by keeping a sharp look out in the spring and destroying with kerosine oil emulsion or by caustic washes, any small colonies that may have arisen from the offspring of winged individuals that have been blown across from affected orchards in the preceding autumn.

The slide now before you is a photograph of a stump of a four year old poplar tree, cut down the middle to show how it has been tunnelled in all directions just above the ground by an insect. This insect is the caterpillar of one of the clear-winged moths allied to, but distinct from, the well known poplar borer of Europe. According to Mr. Cleghorn, who discovered the insect, a very large proportion of the poplar trees around Quetta are attacked in this way, the result being to throw back their growth by several years. Now as the poplar is the chief timber tree of Baluchistan, where it takes the place of the bamboo of Bengal, this means a very serious loss to the country. The caterpillar chiefly chooses young trees for its attack and kills a very large proportion of them down to the ground. The tree then throws out fresh shoots from the roots, and though these may in their turn be attacked, yet some of them usually survive to form a fresh tree. On the screen you now see figures of the caterpillar, chrysalis, and moth of the insect. Also the curious nest-like structure in which the chrysalis is formed. The life-history of the insect has not as yet been completely traced, but sufficient evidence has been collected to make us conclude that it is as follows:—The eggs are laid in the bark by the mother moth, soon after she emerges in the autumn from the chrysalis. The young caterpillars hatch out from these eggs, and tunnel into the wood, where they remain steadily feeding and growing throughout the whole of the following spring and summer. About September they make a regular nest for themselves close to the opening of the burrow, and then shuffle off their larval skins and transform into chrysalids, so that when the moth emerges in October she has only to push through the thin partition of chips which lie between her and freedom. The colours of the moth are brilliant yellow and brown, and this, in combination with her transparent wings, make her look almost exactly like a big wasp. In fact the resemblance is so deceptive that even when one knows that the insect can only be a moth, which never has a sting, one hesitates to touch her, and this no doubt also prevents the birds from molesting her. For birds, like children, know only too well the unpleasant results of trying to swallow a wasp.

With regard to remedies there is at present little to suggest, except that in the case of the poplar borer, as in that of the maize borer, anything that tends to check the healthy flow of sap in the tree, and especially any mechanical injury to the stem, must tend to render the tree suitable as a residence for the caterpillars. This fact we find clearly indicated by the comparative freedom from attack which is enjoyed by the shoots thrown out from the roots of trees that have lost their stems. The explanation being that these shoots have a large amount of root upon which to draw for nourishment and moisture, so that the caterpillar tends to get swamped with moisture in its burrow.

Hieroglphus furcifer.—This insect did a good deal of damage in the latter part of the rains last year by eating up paddy plants in several parts of the Bombay Presidency (Broach, Thana, Panch Mahals, and Rajpipla State), also in the Sambalpur district in the Central Provinces. It is related to the insects which are known as locusts, and no doubt has a very similar life-history, though so far as we at present know it does not migrate to any considerable extent in flights. The injury done by the insect must have been very considerable, for the loss it occasioned in some of the villages of the Panch Mahals is estimated at ten per cent. of the crop, while the area over which it extended was a large one. The insect is said to lay its eggs in the ground in the early part of the cold weather, the young hatching out in the beginning of the following rains, but this requires confirmation. Little seems to have been done by the cultivators to combat the pest, but it was noticed in Broach that heavy rains cleared it off the fields.

Anjoumois moth.—The slide now before you shows the various stages of a moth which has recently been reported as destructive in Kulu granaries. This insect proves to be the grain moth (*Gelechia cerealella*) of Southern Europe and the United States, where it attacks stored wheat, barley, maize, and other grain. It is usually known as the Anjoumois moth, owing to its having first attracted attention in the old Province of Anjou about a century ago. According to the observations of European and American entomologists, the first eggs of the year are generally laid in grain standing in the fields. The eggs are then laid on the ears, and the larvæ tunnel into the grain. The second and subsequent generations are spent in granaries. The normal number of generations being two, though further generations occur when conditions are favourable. The caterpillar tunnels into a single grain, and as in the case of the wheat weevil it remains invisible until just before it transforms into a chrysalis. It then cuts a small round valve-like door which is pushed open by the emerging moth, after it has worked its way through the slight silken cocoon in which the chrysalis is wrapped. The insect passes the winter in the caterpillar stage inside grain stored in granaries. A temperature of 104 degrees Fahrenheit, when continued for two days, is said to have been found sufficiently high to destroy the insect, which is therefore essentially the inhabitant of temperate regions, and is little likely to prove destructive in the plains of India, though it may do a good deal of damage in the hills.

In this connection I may observe that there is a somewhat similar insect, which may perhaps be *Tinea granella*, which attacks stored *dhan* in Bengal to a considerable extent. It differs from *Gelechia cerealella* in living to a greater extent outside the grains, and in spinning the grains together into a silken web, also in pupating in cracks and corners of the granary. In both cases, however, old infested granaries are the sources from which infection arises, so that clearing up the old granaries and removing all the old infested grain before bringing in the new crop is certainly likely to be of use, though the fact that the eggs of the Anjoumois moth are sometimes laid upon grain standing in the fields makes its eradication more difficult than is the case of such a purely granary pest as the wheat weevil and the *dhan* moth.

The next insect which I have to show you is the palm weevil (*Rhynchophorus ferrugineus*), which has been sent to me during the past year, as attacking date palms both in Saharanpur and Lucknow. The insect has long been known as destructive to cocoanut palm trees and often does a great deal of damage. According to Mr. Ridley who investigated the habits of the insect in Singapore, the beetles fly at night and deposit their eggs at the base of the leaf stalks, any mechanical injury, and especially holes made by the rhinoceros beetle in the stalks, being taken advantage of for the purpose. The arvæ tunnel into the heart of the trees, the chrysalids being formed in cocoons made of fibre in the burrow. When badly attacked the trees generally die, but when they are only slightly attacked they often recover. The only measure that seems to have been tried for combating the pest has been the collecting of the beetles by hand.

We now come to the Boll worm (*Heliothis armigera*), which has long been known as attacking the bolls of the cotton plant in the United States and the pods of the opium poppy in India. These two plants, however, form but a very small proportion of the diet of this nearly omnivorous caterpillar, which will eat almost any succulent seeds or shoots that it comes across, and is even said to fall upon other caterpillars and devour them when more natural food is scarce. This is believed to be the caterpillar which has been reported during the past year as destructive to paddy plants in Backerganj and Khulna; the injury in one Sub-division of Backerganj indeed being estimated at an anna in the rupee. It has also been reported by the Bengal Excise Department as attacking the hemp plant in Bengal. The habits of the insect no doubt vary to a certain extent with the locality in which it occurs and the plant upon which it feeds. For instance, in cotton fields in the United States the chrysalis is formed in the ground, while in Indian poppy fields this stage is passed inside the seed capsules of the poppy. But it seems pretty certain that in each case the caterpillars pass the whole of their lives upon the plants, several generations being gone through in the course of the year. One way and another this insect undoubtedly does a great deal of damage in India; but as yet the only remedy which seems to have been tried has been that of collecting the caterpillars by hand, which does not seem a very promising way of getting rid of so small an insect, though more can be done by hand-picking than is usually supposed.

We now come to the red spider, which perhaps should not come within the category of the insects I have undertaken to tell you about to-night—in the first place because it is not an insect, and in the second place, because nobody took the trouble to send it to me last year, though I feel quite safe in saying that it gave a lot of trouble to tea-planters last year both in Assam and the Himalayas. The fact is that the red spider is a mite which is almost always to be found in the dry weather on tea bushes, under a fine web which it spins on the old leaves.

The damage which it does is due to its sucking up the juice of the leaves, and thus causing them to dry up and wither. My chief object in calling your attention to it to-night is in order to notice its connection with the rust mite which attacks oranges in Florida, and which seems from the reports of United States entomologists to have been to a great extent successfully kept under by spraying the bushes with washes made of soapy water in which has been mixed some finely powdered sulphur. I suggested this treatment for red spider in a paper published some years ago by the Agricultural Society. Last year I heard of one tea garden in Darjiling where they were talking of importing a quantity of sulphur for the purpose, but I do not know to what extent the experiment was successful, though the great injury done to the tea industry by the pest would seem to make the matter one of some importance.

I will now show you a few slides of insects which have proved injurious, but on which I will not detain you long. The first illustrates the *toon* borer, *Magiria robusta*, which has been seriously injuring a large number of *toon* trees in Dehra Dun—the caterpillar year after year tunneling into and destroying the leading shoots of the young *toon* trees so that the trees become a mass of stunted branches of but little value for timber purposes. The insect has been previously reported as injurious in Ceylon, but little is known about it, beyond the fact that in Ceylon, moths were obtained in October from larvæ which were full fed in the end of September. The second slide shows the rice sapper (*Gandhi makhi*), which has been again destructive to paddy in Bengal (Champaran). It destroys the paddy grain when still immature, by sticking its proboscis into the unripe ear and sucking up the milk-like juice of the rice. It occurs all over India on rice, and sometimes destroys a large proportion of the crops, especially when the rains set in early. But little is known of its life-history, and with regard to remedies, though smoking the crop by burning vegetable refuse to windward has been recommended by some people, there is nothing to show that it is of any real use.

The third slide shows the rice *Hispa*, which is another very injurious insect, which has again been reported from several parts of Bengal and Burma. It eats away the green parenchymatous tissue of the young rice leaves, and does a great deal of damage. Little has actually been observed of the habits of the insect; but from its zoological affinities we believe that it spends the whole of its life upon the leaves of rice and other grasses, and that it passes through a number of generations in the year. The keeping down therefore of grasses around the rice-fields would seem in this case too to be desirable.

The fourth slide shows a Buprested beetle which I reared last rains from cotton stalks sent to me from Nagpur, where the insect was said to have been doing some damage to country varieties of cotton by tunnelling into the stalks, the American varieties escaping.

The fifth and last slide shows an insect which was sent to me by your Society last rains. It is supposed to have been responsible for the indigo blight of last year, which was estimated to have destroyed a third of the indigo crop. As yet however our information on the subject is very imperfect, and I only show you the insect on account of the very large amount of damage attributed to it.

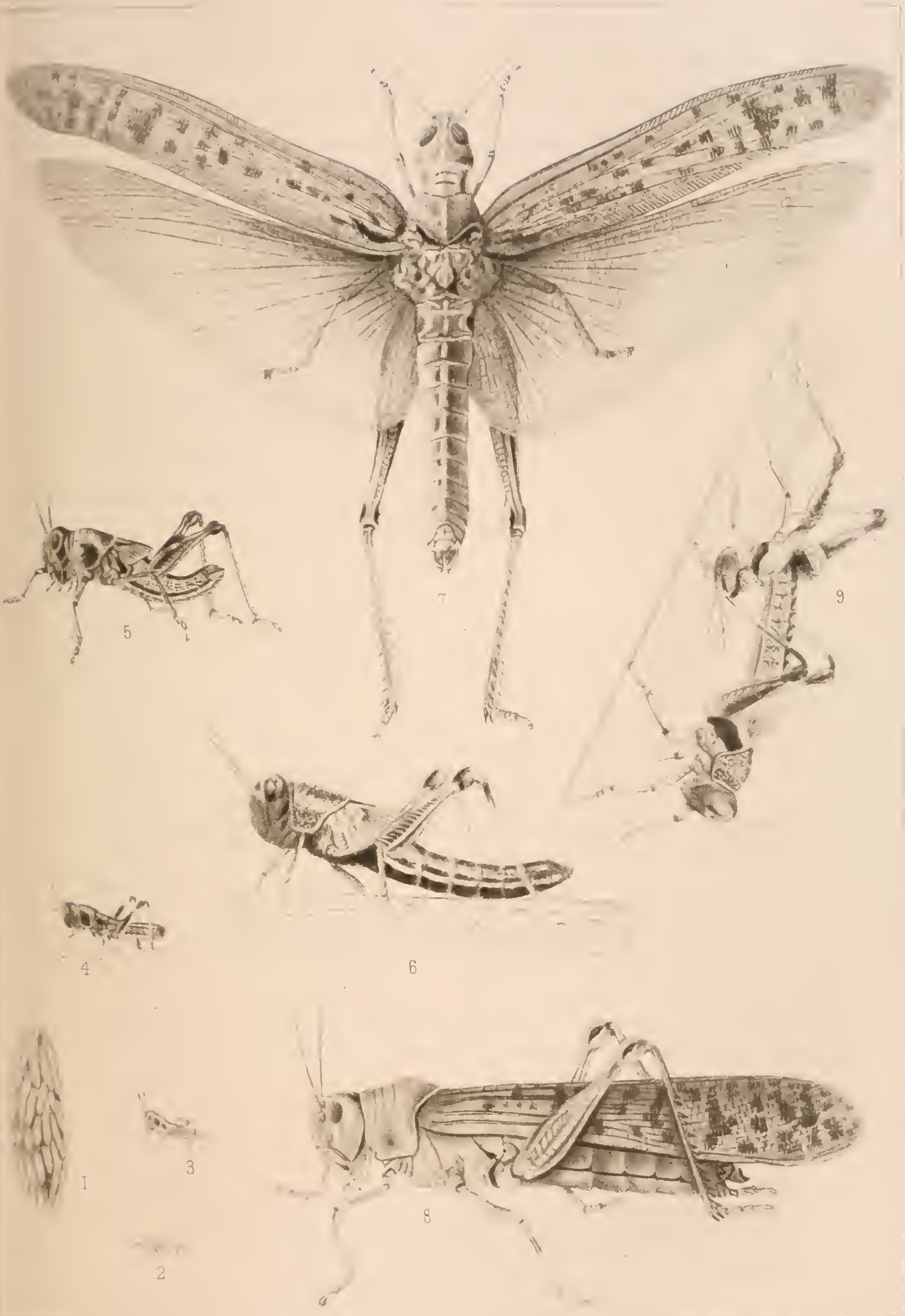
THE LOCUST OF NORTH-WESTERN INDIA.

ACRIDIUM PEREGRINUM.

(*With a plate.*)

Preliminary.

In the summer of 1889, when the locust *Acridium peregrinum* began to appear in North-Western India, the Trustees of the Indian Museum undertook, at the request of the Secretary to the Government of India, in the Revenue and Agricultural Department, to collect information and to furnish a report upon the subject. With this end a preliminary note was issued showing briefly how the question then stood, and indicating the points upon which further information was required. Help was freely afforded on all sides, both by the Government and also by private individuals, a large number of reports and specimens were received; and, in the beginning of the present year, a second note was issued showing the progress made in the investigation. Since then the locust plague has continued unabated, and, though much still remains to be ascertained, it is thought advisable to issue the report, in order to bring the information up to date and to indicate the points which are still uncertain, this being the more necessary as the inquiry has shown that the plague has extended over a very much wider area than was at first supposed,—Persia, Baluchistan, and probably South Afghanistan and Arabia being implicated, as well as North-Western India,—while the Natural History of the insect has proved to be very much less simple, when it occurs over this vast area than when it occurs in the regions of Northern Africa, where it has long been studied by French entomologists.



ACRIDIUM PEREGRINUM.

With its transformations.

1. Bahue of eggs.
2-6 Larvae in various stages of development
7 & 8 Mature Locusts
9. Larva Moulting its Skin

Photo-etching from the original Drawing. Survey of India Offices, Calcutta, January 1891.

Permanent breeding grounds.

In the second note, prominence was given to the fact that the evidence points to the region of sand hills in Western Rajputana as the permanent home of this locust. Subsequent reports, while confirming this point, seem to indicate that though most of the flights issued from this breeding ground, others invaded India from breeding grounds which probably lie along the Suliman Range, or even perhaps, in some cases, beyond India's Western Frontier, in the sandy deserts of Baluchistan, Southern Afghanistan, and Persia, though the reports received from these regions are so fragmentry that no very definite conclusions can be formed from them.

The nature of the country, which forms the chief permanent breeding ground of *Acridium peregrinum* in India, is well described by Surgeon-Major Moore, who wrote as follows in his report on the locust invasion of 1869:—

"The locusts breed in the most sandy and desert districts of Rajputana, especially in the *teeburs* or sand hills of South-Western Manour and Mullanni. The locality mentioned presents a succession of sand hills from 50 to 200 feet high, and some miles long. As a rule, they run in a south-easterly direction. This remarkable tract extends over thousands of square miles, commencing near the Runn of Cutch, and forming a broad belt of country towards Bhawalpur and Bikanir. During the monsoon season it is fairly green from the growth of a species of Mimosa on which the camels feed. At other periods it presents a bright blinding whitened appearance."

Life History.

With regard to the habits of the insect, there still remains a good deal to ascertain. In Algiers, where *Acridium peregrinum* is periodically very destructive to agricultural crops, flights arrive from the Sahara about May, and lay their eggs soon afterwards; and the young locusts which are produced from these eggs, become adult by about July, and by August have usually taken wing, eggs not being again deposited until the following year; but over the wider area, which extends through North-West India into Baluchistan, Persia, and Arabia, it appears that breeding is by no means confined to any one period of the year. Information on the subject is incomplete, but so far as it goes, it seems to show that eggs can be laid at any period in the warmer portion of the year, provided the conditions of soil and moisture are suitable; the close of the winter rains in the North-West Punjab, and the commencement of the south-west monsoon rains in Rajputana, being two of the chief periods during which egg-laying goes on in India.

If we divide that portion of North-West India, in which breeding usually takes place, into two regions, *viz.* (1) Rajputana, including the south-east corner of the Punjab and extending into the North-Western Provinces, an area which generally receives its locusts from the permanent breeding ground in the sand hills of Western Rajputana; and (2) the North-West Punjab, including most of the region bordering upon Afghanistan and Baluchistan, where the locusts seem generally to come from breeding grounds along the Suliman Range or beyond the frontier; we find that in the Rajputana area egg-laying generally takes place at the beginning of the south-west rains, in June or July, and again, if the conditions happen to be favourable, about October; while in the North-west frontier area, egg-laying generally takes place in March or April, and again, if the conditions are favourable, about August. To this rule, as will be seen from the following analysis, there have been several exceptions, which may, however, perhaps, be explained by supposing that flights from the one area have been carried by chance winds, so that they have oviposited in districts which are usually visited by flights belonging to the other area:—

The records which have been found of egg-laying in the invasions of 1889-90, 1869 and 1863, in all of which the species *Acridium peregrinum* was concerned,* are as follows:—

Invasion of 1889-90.—In 1889 egg-laying took place in June and again in October in Jodhpur and Ajmere-Merwara, and in August and September, and again in October, in the Dera Ismail Khan district. In 1890, in March, in the Peshawar, Rawalpindi, and Shikarpur districts; in June in the Jodhpur and Bikanir States, and in the Gurgaon district; in August, in the Kohat, Amritsar, and Ferozepur districts.

Invasion of 1869.—Egg-laying took place in the end of May in Jodhpur; in July in Deesa, Tonk, and Hissar, and again in the latter part of September and beginning of October in Hissar; while in the Dera Ismail Khan district egg-laying took place about April.

Invasion of 1863.—Egg-laying took place in February and March in the Shahpur district, and in July and August in the Hissar district.

Isolated flights.—Turning now to the records of more isolated flights which have appeared in other years, and which no doubt in most cases were composed of insects belonging to the species *Acridium peregrinum*, though there is no direct evidence to this effect beyond the fact that they appeared in regions subject to the invasions of that species. In 1821 eggs were laid on about the 20th of June in Etawah; in 1864 about July in Hissar; in 1865 about the beginning of June in Hissar; in 1866 about July in Hissar, and also in Bikanir; in 1870 in August in Amritsar; in 1872 about July in Jodhpur, also in the early part of July in Rohtak and Jhelum; in 1879 early in March in Meerut; in 1880 in April in Jullundur. With regard to this last there is some doubt as to the identity of the species owing to the fact that Jullundur is sometimes invaded by other species, such as *Acridium melanocorne* and *Acridium succinctum*.

With regard to the breeding of the insect in the vast area extending from the Indus to the Red Sea, too little is known to throw any light upon what goes on the information hitherto received being confined to the following:—According to a native report, dated 1890, about thirty years ago, " in the beginning of spring," locusts deposited eggs in the Barkhan tahsil in Baluchistan; while with regard to Persia, egg-laying was reported in September, 1889, in Shargah, and in February, 1890, in the Bahrein island.

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* Specimens taken from a flight which visited the Mozaffurgarh district in 1863 preserved by Mr. W. Coldstream, establish the identity of the 1863 locust; while the united witness of a number of the reports leaves no room to doubt all that the locust of 1869 was identical with that of 1863 and of 1889-90, though no authentic specimens have yet been discovered.

All the well-known locusts, hitherto studied in other parts of the world, including *Pachytylus migratorius* of the Palæarctic zone, *Caloptenus spretus* of North America, *Stauronotus cruciatus* of Cyprus, *Stauronatus maroccannus* of Northern Africa, and *Acridium succinctum* of the Deccan, have invariably been found to pass through but one generation in the year; and this has also proved to be the case with *Acridium peregrinum* when it occurs in Algeria. The finding, therefore, that in North-Western India, egg-laying goes on more than once in the year in the same locality, has been rather a surprise to entomologists, and it has not yet been definitely ascertained whether the insect really passes through more than one generation in the year, or whether the eggs found in the Autumn are only a second brood laid by the insects which had already oviposited earlier in the year. The evidence hitherto obtained on the subject is somewhat scanty and contradictory,* but on the whole tends to show that in India the insect passes through more than one generation in the year, the autumn broods being the offspring of the young locusts born in the spring; and this supposition becomes still more probable when it is remembered that warmth almost invariably tends to increase the rapidity of insect development, and that if the same set of locusts laid both the early and late batches of eggs, it is impropable that there would be any very well-marked interval of time such as generally occurs, between the two periods of oviposition.

The egg-laying generally takes place shortly after slight rain has fallen: the parent insects copulate, and the female forces her ovipositor for an inch or more into the ground, sandy soil being usually selected for the purpose. In the hole thus made, she deposits a mass of from fifty to one hundred eggs which are gummed together and completely enveloped in a mass of frothy mucilage, which hardens into a spongy solid that fills up the top of the hole and serves to protect the eggs. The eggs take from a fortnight to three weeks to hatch, and the young locusts take from about three weeks to two months to become full-grown and to acquire wings, the length of the time spent as eggs and wingless larvæ appearing to depend chiefly on the temperature and moisture, cold retarding and heat accelerating the devlopement.* When first hatched the young locusts are grass green in colour and quite helpless, but they speedily become almost entirely black in colour, and are then able to hop about five or six inches at a time and begin to feed; after this they change their skins at intervals and grow, becoming more yellowish in colour after each molt. Imperfect wings appear during the last two stages of larval life, and the insect creeps out of its last larval skin with salmon-pink body and fully developed mottled wings, which serve for flight as soon as they are dry. The change from green to black, which takes place a few hours after the larval escape from the eggs, is no doubt due to the molting of the green skin, but this change takes place so rapidly that the actual molting of the skin has not been observed.† After this, two molts take place before the insect changes its skin for the last time, to emerge as a winged locust, so that altogether the insect molts its skin four times. After acquiring wings the young locusts soon take wing and form the flights which travel about the country, sometimes for months, alighting at intervals to feed upon the crops, until the time comes, either to oviposit, or else to die off owing to the inhospitable nature of the areas into which they have penetrated. As they get older the colour of the winged insects changes from pink to yellow—a transformation which in Algeria has been supposed to mark the sexual maturity of the insect, though from what has been observed in India there would seem to be some doubt about this point.

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* It is as follows:—(1) The locusts, which oviposited in Deesa in the beginning of the rains of 1869, were observed by Colonel Swinhoe to die off rapidly afterwards, so that they could not have been the parents of the autumn brood of that year. (2) In the Hissar district, which is very subject to invasion from Bikanir, young locusts born about July, are reported by the Naib Tahsildar of Sirsa to be said to oviposit about October, when there has been rain in that month. (3) In the Rawalpind division in 1890 Captain H. A. Deane observed that the locusts which oviposited in August were brighter in colour, more vigorous, and, he believed, younger than those which had oviposited in the previous spring. (4) On the other hand, there is the fact that the locusts, observed by Dr. Ross in Rawalpindi in 1890, appeared to be as vigorous as ever after depositing their eggs, and might therefore have been the parents of a subsequent brood.

Summary of the life history.

As far as the present information goes therefore, it seems likely that the life-history of *Acridium peregrinum* in India is shortly as follows. But it should be borne in mind that several of the points, especially in connection with the parentage of the second generation, are not definitely established, and may prove to be erroneous. Permanent breeding-grounds lie in the sand-hills of Western Rajputana and in the Suliman Range. Here the flights remain comparatively inactive during the cold weather, waiting for the warm showers to soften the hard sandy soil in which they lay their eggs. These showers come in the latter part of the winter rains of the North-West Punjab, and in the beginning of the south-west monsoon in Western Rajputana. Egg-laying therefore takes place about March and April in the North-West Punjab, and about June and July in Rajputana. Each female after copulation lays an agglutinated mass of from fifty to one hundred eggs, about the size of small dry grains of husked rice, in a hole about an inch deep, which she bores with her horny ovipositor in the sand. She may perhaps lay more than one of these masses, but it is believed that neither of the parents long survive the laying of the eggs, though the yellow individuals, often found in small numbers amongst the young salmon-pink locusts which chiefly compose the autumn flights, have been supposed to be survivors from the flights of parent insects which are found in the spring. The eggs hatch in about three weeks, and from them emerge young wingless locusts, which hop along the ground devouring the crops, and gradually increasing in size until they are about one or two months old, when they acquire wings. Shortly after this they take flight, and fly about the country in swarms, which descend at intervals to devour the crops, and often penetrate right across India. Those insects which leave the dry sandy country of their home and penetrate into the damper regions of the North-West Provinces, the Central Provinces, Bombay, Bengal, Madras, and Assam seem for the most part to die off without ovipositing. The flights, however, which remain in the drier regions of the Punjab and Rajputana are believed to lay their eggs towards the latter part of the rains, in August, September, or October, the young locusts acquiring wings in the beginning of the cold weather and forming the flights which oviposit in the following year, while the parent insects gradually die off like their own progenitors in the previous spring.

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* In the spring of 1890, eggs both in Rawalpindi and in Shikarpur took about three weeks to hatch. Larvæ reared in Rawalpindi took about eight weeks to develop, while larvæ from Shikarpur eggs, reared in Calcutta, became full-grown in a month, a marked acceleration in development occurring after they had been supplied with water. In Hissar, in 1889, eggs were said to have hatched in fifteen days, and the young locusts to have acquired wings three weeks after hatching out.

† The shortness of the period passed by the insect in this stage, combined with the fact that its surroundings are the same when it is green as when it is almost black, would seem to indicate that the green stage is a survival, probably presenting the predominant coloration of the ancestral form, and hence indicating that this desert species is descended from some inhabitant of more fertile lands where green coloration would be as advantageous in rendering it inconspicuous amongst foliage as its present black coloration no doubt is in the desert, where the birds are likely to mistake it for the black shadow of a pebble upon the sand.

Damage occasioned.

Although nearly every district in North-West India has been visited, at some time or other during the past two years, by flights square miles in extent, and sometimes so thick as to hide the sun from sight, as they passed in the air, and to break down with their sheer weight thick branches of the trees upon which they settled, yet upon the whole no very serious damage seems to have been occasioned to the crops, though no doubt sparsely-inhabited areas, such as parts of Western Rajputana, have in some cases sustained considerable injury. The explanation of this lies in the fact that in the case of the winged insects the flights usually passed rapidly from place to place, so that a very large number of districts were visited by a comparatively small number of swarms, which usually only stopped in one place long enough to damage a small area, and then passed on to levy contributions elsewhere. The result of this has been that the very large amount of total damage, that must have been occasioned from first to last, has been spread over too wide an area to be particularly felt in any single district. In the case of the wingless insects on the other hand, which are known to be capable of most disastrous ravages, eggs were only laid in a few cases in British districts, and even then not in overwhelming numbers, and the vigorous measures taken by the District Officers in destroying the young insects wherever they emerged seem to have been attended with such success that no very serious damage occurred. It is only therefore in some of the States of Western Rajputana, where the insects were very numerous and the people too sparsely scattered and apathetic to cope with the evil, that any serious injury has been sustained, and even of this no definite estimates have been received, and the fact can only be inferred from such expressions as "great damage," "immense harm," and "considerable damage," which occur in the reports received from the Jodhpur, Jeysulmere, Sirohi, and Bikanir States. Slight damage to the crops has been reported from Sind, the Punjab, North-West Provinces, from several of the States of Eastern Rajputana, and from the Central Provinces, Bengal, Bombay, and Madras, but in almost all cases it seems to have been confined to comparatively small areas, and no general estimates have been received of its total amount. And the chief point to notice with regard to it is that the amount of damage done by a swarm generally becomes less and less as it wanders away from its home in the North-West into the (to it) inhospitable regions of the more fertile and thickly populated provinces. The flights which visited the North-West Provinces in the cold weather of 1889 were generally reported by the District Officers as doing but slight or trifling damage, the following being the worst cases:—In the Fatehpur district the damage was estimated at two annas in the rupee; in the Hamirpur and Bahraich districts at one anna in the rupee; in Jaunpur at six pies in the rupee; in Jhansi as considerable in ten or twelve villages; in the Tarai as considerable in one pargana. The total damage done in the Ajmere-Merwara district in 1889-90 was estimated at about Rs. 20,000, and this was thought by the Collector to be slightly exaggerated. In the case of the flight which visited the Anakapalle taluk in the Vizagapatam district, Madras, on 18th November, 1889, the damage done to the *ragi* crop was estimated at about Rs. 150.

The chief crops reported as injured by the locusts have been cotton, indigo, *til*, *bajra*, *jowar*, wheat, gram, and grass, but the insects are evidently not very particular in their tastes, and will probably eat almost any field or garden crop they come across. They also attack the foliage of various trees with great avidity, sirris, pepul, chir, and various Acacias having been noticed as particularly suffering. One writer even describes how the hard red bark of babool trees was gnawed so as to lay the wood bare and white from root to top, and almost the only plant to which they seem to show an aversion is tea—a fact which was noticed both some years ago when a flight visited Dehra Dun in the North-West Provinces, and again in November, 1890, in Dhubri, Assam, where a stray flight did some damage to garden crops, but scarcely touched the tea bushes.

Measures adopted against the locusts.

There seems to be no doubt but that where the population is fairly dense and combined efforts are made by the cultivators to destroy the insects, much injury to the crops can be prevented without any undue expenditure of labour. The best time to attack the insects is shortly after they hatch out from the eggs, when they are little helpless creatures, which can easily be destroyed by driving them into pits or lines of burning straw, or even by crushing them on the ground; but useful work can also be done by collecting the eggs and by beating the winged insects off the crops upon which they settle. The precise measures which are most appropriate for adoption in each case must of course depend to a great extent upon the nature of the ground and the labour and appliances that are available; but the experience of the past invasion, especially in Rawalpindi, Peshawar, Kohat, and Hissar, has shown conclusively what excellent results can be obtained when the officials organize the measures of attack, and impress upon the people the fact that combined and energetic action on their own part is more efficacious than charms and votive offerings in saving their crops from destruction.

In Rawalpindi the Deputy Commissioner reports that he had no difficulty, except where tahsildars were careless, in obtaining accurate information as to the laying of eggs. Men were specially employed to note where the flights rested, and during April, 1890, whenever they stayed on sandy soil for the night, eggs were usually deposited. These were at once dug up, and in no spot so dealt with were young hatched. Mere ploughing of land in which eggs had been deposited was thought to be useless, as the eggs were found to hatch out easily even when detached from the egg tubes and exposed to the air. In this way about five hundred maunds of eggs were destroyed, and after about the same quantity of young locusts had been accounted for, the Deputy Commissioner was able to report that the pest had been thoroughly stamped out without damage to the crops.

In the Peshawar Division one hundred and twenty-nine maunds of young locusts and eggs were destroyed by the tahsildars during April and May, 1890; and the pest seems to have been to a great extent stamped out, in spite of the refusal, on religious grounds, of the Afridis to co-operate by destroying the young locusts in the neighbouring hills. The method generally adopted was that of driving the young locusts into trenches; Cyprus screens,* however, being also used in a few places.

In Kohat the Deputy Commissioner reports that vigorous measures were taken by the tahsildars for the destruction of the locusts, by driving them, when very young, into pits, and later on, when they could hop further, by driving them on to bushes which were then burnt. Vast numbers were in this way destroyed (over a thousand maunds of young locusts being reported as destroyed in a single tahsil), and the pest was, at least for the time, almost completely stamped out.

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* The Cyprus screen system consists of a series of cloth screens from two to three feet high, bound along the upper edge with a strip of oilcloth to prevent the locusts from climbing over. A long line of these screens is erected in front of an advancing swarm of young wingless locusts, so as to form an impassable barrier for them; pits are dug at intervals, close to the screens and at right angles to them, on the side towards the advancing swarm. The edges of the pits are guarded by frames, made of cloth and wood, with overhanging zinc edges, arranged to prevent the escape of the locusts from the pits. The swarms, on arriving at the screens, are found to turn to the right and left, apparently endeavouring to go round them, and when they come to the pits they pour into them, and, being unable to escape, can be destroyed wholesale.

In the Hissar district, according to the report of the Deputy Commissioner, pits were used for destroying the young locusts ; also the bushes on which the young locusts rested during the heat of the day were beaten with branches to kill the insects, and as they grew bigger they were destroyed by piling thorns round the bushes on which they rested and setting fire to them.

In the Bikanir Agency in 1890 (according to the official diary) efforts were made to destroy the young locusts by sweeping them into trenches, but they were in such numbers that success was only partial. In the Marwar, Jeysulmere, and Sirohi States also, it is reported that the Rajput cultivators and landowners destroyed many of the insects by means of trenches, but the destruction seems to have been unsystematic and to have done but little good.

The keeping of the winged flights off the crops by lighting fires, beating tom-toms, waving sheets in the air, and beating with palm leaves, seems to have been generally adopted, in many cases with considerable success—*vide* numerous reports from different districts in the Punjab, North-West Provinces, the Central Provinces, &c.

The following extract from report by the Collector, Ajmere, is of interest in connection with the measures that can be adopted :—

"The first reports regarding locusts were received about the 15th July, 1889. It was then stated that young locusts had come out of the earth in great numbers in the low sandy tracts in Marwar (Jodhpur) bordering the Marwara hills, and that they were advancing towards Marwara. On the 27th July the first swarm reached our border, and as others were approaching, I went to the spot with Mr. Egerton in order to take such measures as might appear appropriate. The locusts had got imperfectly developed wings and were unable to fly. The Western Marwara border runs through rocky forest-clad country, and our object was to prevent the locusts from penetrating the forest which, on our side of the frontier, is 2 to 4 miles broad, and behind which the cultivated area extends. A large number of villagers were called out, and in order to enable them to come, and to make sure that they would stay, they were allowed to bring their cattle and graze them in the forest reserves near the border. It was also supposed that the cattle might help in destroying the locusts, but though they did eat them, they could not be said to be of any real use. They were organized in gangs, and wherever the locusts appeared they were beaten down with strips of bark about 4 feet long and 1 foot broad taken off the neighbouring trees. The bark is very tough and each strip served for many days. Large numbers of locusts were killed in this way. It was impossible to dig trenches in the rocky soil, and the procedure adopted was a complete success. Nothing was touched on our side of the border, while not a blade of grass was left on the Jodhpur side, where nothing was done to prevent the destruction. The struggle with these wingless insects went on for about a month. They appeared continually in different places, though not in very great swarms, and were as regularly beaten down. The total length of border attacked was only about 20 miles long, extending from Dooderia to Chala. Towards the end of August the locusts took flight, and from that time till January they invaded at intervals almost every part of the district. In this stage it appears impossible to destroy them, but it appears possible to prevent them from settling in the crops, if a sufficient number of men can be collected in time. I have frequently seen large swarms of locusts, just settling down, take to flight again when the villagers ran through the fields beating the plants with clothes. It also appears that the firing of guns is useful: a shot fired into a swarm of locusts will immediately clear a space of about 50 yards in circumference."

Locusts as human food.

Generally speaking, the people seem not to have made use of the locusts as food, though there is evidence to show that they are by no means unpalatable. But a large flight which visited Hardoi in Oudh in June, 1890, was reported by the Deputy Commissioner to have afforded welcome food to the poorer classes. In Dharmsala, also, in November, 1890, the natives were said to have largely utilised the locusts as food; while in the case of the Marwar, Jeysulmere, and Sirohi States of Western Rajputana, it is reported that, where the Musalmans predominated, the poor collected and boiled the locusts in salt water, obtaining in this way a supply of food both for themselves and for their horses and camels, which will eat the locusts and are said to thrive upon them.

Diseases and natural enemies of the locusts.

The entire disappearance of the flights which invaded the North-West Provinces in the cold weather of 1889 indicates that the mortality amongst the locusts was very much greater than could be accounted for by the measures adopted by the people. The insect is essentially the inhabitant of the desert, and it is undoubtedly the case that the dampness of the more fertile regions into which it has penetrated is totally unsuited to its constitution, though as yet little is known of the parasitic animals and fungoid diseases by which it is likely to be affected. Some alcoholic specimens indeed from the Red Sea were accompanied by the larvæ of a dipterous insect which is likely to have been parasitic upon them, but nothing of the kind has yet been discovered in any of the numerous individuals which have been kept under observation in cages in the Indian Museum. In the case of the flight which visited Calcutta in November, 1890, the insects were very weakly, and were being so rapidly eaten up by birds of all kinds, and especially by kites, that there seemed every probability of their being speedily exterminated by that agency alone. In Rawalpindi also, Captain H. A. Deane wrote that they were much attacked by a yellow wagtail (scientific name not recorded), which was in very unusually large flocks in the district, and congregated wherever locusts were hatched. Bears also in Dharmsala were said to have gorged themselves so thoroughly on the locusts that several of them were shot close to the station.

In this connection it is probable that much remains to be discovered, as the observations made upon other locusts in different parts of the world make it likely that the Indian species is subject to the attack of many more predaceous animals and parasites than have yet been recorded.

Movements of the locusts during 1889-90.

In compiling this account of the movements of the locusts during the year 1889-90, it has been found that much reliance cannot always be placed upon the notices given in the reports of the tracks followed by the flights, as it is quite evident that in many cases the first arrival of a flight in a district was unnoticed, and the direction, therefore, which has been given as that of its origin is often little more than the direction in which it happened to be moving when it crossed over some station, after it had been wandering about the district for some time, this direction being consequently in many cases entirely different from that from which it originally came. It has therefore been impossible to trace with any approximation to accuracy the actual wanderings of each particular flight, and in the following notes it is only the general directions of movement which are indicated at all, and these only in cases where the information seems to be reliable.

The locusts were first reported in June, 1889, when flights were observed in Sind, and also in the Jodhpur (Marwar), Jeysulmere, and Sirohi States of Rajputana. The only notice of the origin of this flight is in one of the Rajputana reports, where they are said to have come partly from Sind and partly from Bikanir. Much reliance, however, cannot be placed upon this isolated statement, the probabilities being that the flights in Western Rajputana originated chiefly in the sand hills of that region. The origin of those in Sind is somewhat more problematical, the most likely supposition being that they originated locally in the sparsely vegetated sandy hills which are to be found in Sind itself, though it is also possible that they flew across either from Baluchistan or from Western Rajputana.

In July, flights were noticed in Bikanir, whence they penetrated northwards into Sirsa and westwards into the Jeypore State. Flights of uncertain origin were also noticed in the Shahpur district in the Punjab; while young locusts hatched out both in Jodhpur and in Ajmere-Merwara showing that winged flights had been present in both these areas in the previous month, though they were not noticed in Ajmere-Merwara.

In August, 1889, young wingless locusts were present in the Jodhpur (Marwar) State, and in Ajmere-Merwara, acquiring wings towards the latter part of the month. Winged locusts were again reported in the Jeypore and Bikanir States, while a flight of uncertain origin appeared in the Dera Ismail Khan district of the Punjab and deposited eggs.

In September, 1889, the young locusts noticed in Jodhpur and Ajmere-Merwara in the previous month seem to have commenced spreading in flights, as locusts were noticed in all parts of Rajputana (Jeypur, Ulwar, Kerowli, Bundi, Shahpura, Jhallawar, Ajmere-Merwara, and Bikanir). At the same time further spreading took place in the Punjab, the Multan, Dera Ghazi Khan, Dera Ismail Khan, and Shahpur districts being invaded. The origin of these flights has not been satisfactorily traced, but the fact that the eggs were deposited both in August and September in the Dera Ismail Khan district, and in the early part of September in the Dera Ghazi Khan district, would seem to point to their having had, at least in this case, an origin other than Western Rajputana, where the breeding season had recently terminated. Locusts were also reported in this month in Shikarpur and in Ahmedabad. In the case of Ahmedabad, however, no specimens were obtained, and there seems to be some doubt as to the identity of the locust which was said to have appeared. It was in this month that the first locusts were reported as being noticed in Persia; Shargah being invaded by flights which were said to have deposited eggs, and not to have disappeared until about June, 1890. Flights were also reported as present in parts of British Baluchistan. The Persian and Baluchistan reports, however, are from too limited areas to admit of any very general conclusions being based upon them.

In October, 1889, flights were again reported from Sind, the Western Punjab (Multan, Shahpur, and Dera Ghazi Khan), and Rajputana (Jeypur, Ulwar, Bhurtpur, Tonk, Bundi, Shahpura, Jhallawar, Ajmere-Merwara, and Jodhpur), as well as from Allahabad in the North-West Provinces, and from Ahmedabad, Baroda, and Khandeish to the south. They also appeared in the island of Kishim in the Persian Gulf. There is evidence to shew that eggs were laid both in Jodhpur and Ajmere-Merwara about this time, but the precise dates are somewhat uncertain. Eggs were also reported to have been laid in this month in the Dera Ghazi Khan district, and it is thought probable that these eggs, unlike the eggs deposited in this district in September, were laid by a stray flight from Rajputana.

In November, 1889, young locusts hatched out in Ajmere-Merwara. Flights were again reported in many parts of Rajputana (Bikanir, Ulwar, Bhurtpur, Kerowli, Dholepur, Bundi, Shahpura, Tonk, Kotah, Jhallawar, Ajmere-Merwara, and Jeypur), and there was a general movement towards the east, the whole of the North-West Provinces (Muttra, Aligarh, Jhansi, Etah, Hardoi, Hamirpur, Banda, Agra, Bara Banki, Fatehpur, Jalaun, Kheri, Rae Bareli, Cawnpur, Etawah, Bareilly, Kumaon, Shahjahanpur, Unao, Tarai, Bahraich, Gonda, Jaunpur, Lalitpur, and Sultanpur) being visited at intervals by flights which appear to have flown across from Rajputana. A stray flight also reached the Vizagapatam, Kishna, and Godavari districts in the Madras Presidency, but the precise route taken by it has not been traced. In this month the locusts appear to have been widely prevalent over a vast area to the west, their presence being noticed all up the Persian Gulf and also in the Red Sea.

In December, 1889, flights were again reported from Rajputana (Jeypur, Ulwar, Bhurtpur, Jhallawar, and Ajmere-Merwara), the North-West Provinces (Rae Bareli, Fatehgarh, Naini Tal, Muttra, Azamgarh, Basti, Gharwal, Fyzabad), the Vizagapatam district in the Madras Presidency, the Goona Agency in Central India, and from parts of British Baluchistan (Harni route between Sibi and Sharig, Khort-Kharmai, and further camp stations). The cold, however, appears to have begun to tell upon them, as reports of their appearance in this month are very much less numerous than in November.

In January, 1890, there seems to have been still less activity amongst the flights, as the only report of their presence in Rajputana is from Ajmere-Merwara, though they spread to some extent over parts of the Punjab (Lahore, Ferozepur, Muzaffargarh, Dera Ghazi Khan, Dera Ismail Khan, Rawalpindi, and Jhelum); and were noticed in parts of Sind, also in Agra in the North-West Provinces, and in the Kistna district in Madras, a big flight being also indefinitely reported as present in British Baluchistan.

During February, 1890, flights were still to be found in the Punjab (Lahore, Rawalpindi, Dera Ismail Khan, Jhelum, Amritsar, and Shahpur), and in Sind (Shikarpur and Upper Sind Frontier), as well as in British Baluchistan and in Persia. They were also said to have bred in the Bahrein Island in the Persian Gulf, and, according to a native report from Quetta, young locusts hatched out in Afghanistan near Kandahar. Much reliance, however, cannot be placed on this last information, and it is thought not improbable that the young insects referred to had been seen, some time in the summer of 1889, in the sandy Rajistan desert, which is very likely to be one of the regular breeding-grounds of the insect. The flights which had invaded the North-West Provinces and Madras seem by this time to have died off, as nothing was heard of them after January.

In March, 1890, flights were reported from Amritsar, Dera Ismail Khan, Peshawar, and Rawalpindi in the Punjab; from Shikarpur and the Upper Sind Frontier in Sind; as well as from British Baluchistan and from Persia; and eggs were laid in considerable numbers in the Peshawar, Rawalpindi, and Shikarpur districts.

In April, 1890, young locusts hatched out in large numbers in Shikarpur, and also in Rawalpindi. In Shikarpur most of the hatching seems to have taken place in the early part of the month, and some of the locusts reared in Calcutta from eggs sent from Shikarpur acquired wings before the end of the month; but in Rawalpindi the brood was somewhat later, most of the hatching taking place about the middle of the month.

In May, 1890, flights were reported in the Hyderabad, Upper Sind Frontier, and Karachi districts, the direction of their origin appearing to be chiefly from the west, though much reliance cannot be placed upon this statement for the reasons already indicated.

In June, 1890, on the 1st of the month, the young locusts in Rawalpindi were said to be acquiring wings, and shortly afterwards numerous winged flights were reported from Sind (Shikarpur, Hyderabad, and Upper Sind Frontier); while there is indirect evidence to shew that they were largely present in Rajputana, though actual reports of their appearance have only been received from Bikanir and Bhurtpur. There was also a general movement across the North-West Provinces and Oudh, flights being reported from Agra, Hardoi, Sultanpur, Partabgarh, Fyzabad, Cawnpur, Banda, Farukabad, Hamirpur, Jhansi, Azimgarh, Muzuffarnagar, Etah, Allahabad, Jaunpur, and Lucknow. Towards the latter part of the month, flights appeared in the Gurgaon district of the Punjab from the west and laid eggs from which emerged young locusts, which were still being destroyed in the beginning of August; when the report was received. No information has been received about the movement of the locusts in Baluchistan and Persia during this month, but the steamer *Yang-tse* is reported to have passed through vast masses of locusts which were found floating over some 300 miles of her course in the Red Sea.

In July, 1890, flights were again reported from Sind (Karachi, Shikarpur, Hyderabad, and Upper Sind Frontier), also from parts of the Punjab (Lahore, Umballa, Amritsar, and Delhi), while notice was incidentally received of their presence in Shiraz (Persia). But the most important feature to notice in this month is the very extensive breeding of young locusts which took place in the Jodhpur and Bikanir States of Rajputana, as it is probable that these insects were the ones which compose the flights that afterwards invaded the whole of the Central Provinces and the Presidencies of Bombay, Madras, and Bengal. The young locusts already referred to were present during the whole of this month in the Gurgaon district of the Punjab, but they appear to have been comparatively few in number: they were no doubt the offspring of some stray flight from Bikanir.

In August, 1890, egg-laying took place in the Kohat and Amritsar districts. Flights were reported from various parts of the Punjab (Muzaffargarh, Kohat, Multan, Dera Ismail Khan, Shahpur, Ferozepur, Amritsar, and Lahore), also from Sind (Karachi, Shikarpur, Hyderabad, and Upper Sind Frontier) and from Agra; while young locusts were still being destroyed in the Gurgaon district. Outside India, the Peninsular and Oriental ship *Rome* passed through vast flights both along the shores of Arabia near to Aden, and also for two days after entering the southern portion of the Red Sea. Winged locusts also were reported from Quetta, though in what numbers is uncertain.

In September, 1890, in the beginning of the month, young locusts were reported from Ferozepur; also egg-laying in several villages of Kohat. Flights were reported from Agra and various parts of Sind (Karachi, Hyderabad, and Shikarpur), and a general move was made into the Central Provinces, the Hoshangabad, Nagpur, and Balaghat districts being visited by large flights which seemed generally to come from the North-West, and which did a considerable amount of injury to the crops in the villages where they settled.

In October, 1890, flights were reported in the Hyderabad, Upper Sind Frontier, Karachi, and Shikarpur districts in Sind, in the Ajmere district, and in Bikanir, Bhurtpur, and Alwar States in Rajputana; also in the Dera Ismail Khan, Shahpur, Amritsar, and Lahore districts of the Punjab, and in the Agra, Fatehpur, Hamirpur, and Fyzabad districts of the North-West Provinces. Flights also reached the Himalayas (Kumaon, Naini Tal, Simla, and Bashahr), passing and repasseing over the outer ranges. But the most noticeable feature in this month was the general movement that was made by the flights, through Central India, into the

Central Provinces (Hoshangabad, Seoni, Chindwara, Nagpur, Bhandara, Jabalpur, Bilaspur, Raipur, Saugor, and Balaghat); and thence eastwards into Bengal; southwards, through Berar and Hyderabad, into the Ganjam, Kurnool, Cuddapah, and North Arcot districts of Madras; and westwards into the Ahmadnagar, Poona, and Dharwar districts of Bombay. The flights were said to have caused some injury to crops, especially in Sind and the Central Provinces, cotton, *arar*, *urd*, *tili*, *kutki*, *koda*, *jagni*, *tur*, and *jowar* being all reported as suffering, as well as trees, such as the chir (*Pinus excelsa*); but the people seem to have had little difficulty in keeping them off the crops, and the injury occasioned does not appear to have been of at all a serious nature.

In November, 1890, flights were reported from the Punjab (Lahore, Amritsar, and Dharmsala), from Sind (Karachi, Hyderabad, Shikarpur, and Upper Sind Frontier), also from the Bhopawar Agency in Gwalior, and from Sambalpur in the Central Provinces, while they continued to spread throughout the Bombay-Deccan, Madras, and Bengal, penetrating even as far as Dhubri in Assam. In Bengal they were reported from Lohardugga, Bankoora, Maldah, Bogra, Furreedpur, Calcutta, Howrah, the 24-Pergunnahs, Dinagepur, and Rungpur; in the Bombay-Deccan, from Sholapur, Poona, Bijapur, Dharwar, Kanara, Satara, Ratnagiri, Broach, Rajpipla, and the Mahikantha tract; in Madras, from Ganjam, Cuddapah, Bellary, Anantapur, and North Arcot. Slight injury to the crops was reported from parts of Sind, Bombay, Bengal, and Madras, but the flights do not seem to have been very large ones, and in the case of the one which visited Calcutta, the insects were so weakly, and were being so rapidly eaten up by birds of all kinds, and especially by kites, that there seemed to be every probability that they would speedily be exterminated by this agency alone.

Previous invasions of *Acridium peregrinum* in India.

The following is a summary of the records which have been collected of previous invasions of locusts which, at least in most of the cases, are practically certain to have belonged to the species *Acridium peregrinum*. These records cease with the year 1880, and no information has been obtained of the presence of locusts likely to have belonged to the species *Acridium peregrinum* between the years 1880 and 1889. It is probable therefore that during this period the insect was unusually scarce and confined itself to its permanent breeding-ground in the desert, where it would be little likely to attract notice.

In the year 1812, according to Hunter's Gazetteer, locusts did some injury in Ahmedabad and Broach. In 1821 they visited Etawah, the following being an abstract of the account given by Playfair (Trans. Med. Phys. Soc., Calcutta, 1825):—

On 20th June, 1821, a large flight of locusts appeared at Etawah and settled in the fields; vast numbers of the locusts then copulated and hovered about the place for about a month before taking their departure. On 18th July vast swarms of young locusts emerged and proceeded to move slowly over the country, devouring the vegetation as they went. The cultivators tried to sweep them back from their fields, and by driving and sweeping them into heaps, which they burnt, they destroyed vast numbers; the birds also destroyed great numbers of them. By lighting fires round their fields, the cultivators endeavoured to prevent their entry. The numbers of the locusts, however, seemed to be unaffected, and the invasion proved too vast for any individual action to be of much service. The fires could not be kept constantly burning, and as soon as they went out, the locusts crowded across them. The locusts were observed up to 31st July, by which time many of them had transformed into pupæ; great damage had then been done, and this, combined with the previous drought, ruined many of the cultivators. About 31st July flights of winged locusts were seen to pass overhead. When rain was actually falling, it drove the young locusts into the trees and fences for shelter, but seemed to have no permanent effect upon them.

In 1834, according to Hunter's Gazetteer, locusts ate up the crops in Kaira, and remissions in the revenue amounting to £19,655 were sanctioned; in Ahmedabad also, where the rainfall was deficient, the distress was increased by vast swarms of locusts. In 1843-44 Rawalpindi suffered severely, the following being an extract from Hunter's Gazetteer on the subject:—

The locusts "appeared just in time to devour the whole autumn crop of 1843; they remained for the succeeding spring crops, and at last took their departure after utterly destroying the autumn harvest of 1844. Rawalpindi is still suffering from the remote effects of this terrible visitation. The Sikh authorities insisted upon realizing the utmost farthing of their revenue from the starving cultivators, who were obliged to have recourse to the trading classes, and so commenced a system of chronic indebtedness which has not even yet entirely passed away. The tenures of land were completely revolutionized, to the great disadvantage of the proprietary class, as the Sikhs admitted tenants to share the burdens and privileges of the landowners, in order the more readily to collect their exorbitant imposts. The British Courts were for long flooded with litigation arising from the disorganization of this unhappy period."

In 1863 there was a wide-spread visitation of locusts in the Punjab and Rajputana, but no very complete records have been found of their history. Specimens from Muzuffargarh, preserved by Mr. W. Coldstream, shew that the insect belonged to the species *Acridium peregrinum*. As in other invasions the insect seems to have bred in the early spring in parts of the Punjab, and in the beginning of the south-west monsoon in the districts bordering upon the Rajputana desert; and the fact that a considerable flight reached Dacca in the cold weather (report of the present Commissioner of Chittagong) would seem to show that the plague continued throughout the greater portion of the year.

In the Shahpur district (according to the report of the Deputy Commissioner) large flights appeared in February and March, but they were little noticed. When, however, the eggs were expected to hatch out, rewards were offered for them, and 186 maunds of eggs were brought in by the villagers and destroyed, the total cost being about Rs. 305. Rewards were also offered for young locusts, and 2,272 maunds of them were destroyed at a cost of Rs. 710, most of them being brought in by the villagers for the reward and some being destroyed locally by driving them into trenches and fires. But little damage was done either to the old *rabi* or to the young *kharif* crops. The young locusts which escaped destruction acquired wings and afterwards flew about the district, but they were not allowed to settle on the crops, and did little damage.

In the Hissar district (Deputy Commissioner's report) flights appeared in February and March, and again in still vaster numbers in June and July. Eggs began to be found about July, and ploughing was largely tried, but was generally given up as useless. In the latter part of July young locusts emerged in vast numbers: rewards were offered for eggs and young locusts, trenches were dug in all directions, and vast numbers were destroyed. In the latter part of August more flights appeared and eggs were again deposited, the measures taken for destroying the eggs having to be continued vigorously until the middle of October. On the whole, however, very little damage was done in the district.

In the Muzaffargarh district (Mr. W. Coldstream's notes) a large flight, from the Rajputana desert, appeared in the early part of July and did some damage.

The above is all that has been ascertained on the subject of the invasion of individual districts in 1863, but the following extract from a report, dated 29th July, 1863, by the Secretary to the Punjab Finance Commissioner, shows the serious nature of the evil :—

"The young locusts, I regret to say, have begun to be hatched at Lahore itself, where there was previously no suspicion even of eggs having been laid, as also in the Gurdaspur district, in vast numbers. The old locusts have been laying their eggs at Sirsa, Hissar, Rohtak, Patiala, and other parts of the Sutlej, while they are stated to be laying them broadcast in Bikanir and other parts of Rajputana. In the Derajat and Peshawar divisions, as well as in Rawalpindi, and, it is to be feared, throughout the Salt Range and elsewhere in the north, the same process appears to be going on ; so it appears certain the coming crops must be devastated far and wide, more especially the cotton crops, which have already begun to suffer, if the most resolute efforts be not made to destroy the eggs and young broods before they attain to maturity."

From 1864 to 1868 inclusive, the only records of locusts likely to have belonged to the species *Acridium peregrinum* are from the Hissar district (report of the Deputy Commissioner), where a very careful record seems to have been kept. In this district, in 1864, flights appeared in July and August and laid eggs which hatched in the middle of August, very slight damage being occasioned : in 1865 flights appeared in June, July and August, and again in November, young locusts being found as early as the end of June ; in 1866 a few locusts appeared in June, and young hatched out in August. In 1867 a small flight appeared in July.

In 1869, after prolonged drought, the whole of Rajputana and the Punjab* were invaded by vast flights of locusts, which are reported to have come in the south from the *teeburs*, or sandhills, of Western Rajputana, and to the north from the direction of the Suliman Range. They did a great amount of injury, especially in Siorhi, Ajmere, and Marwar, where the distress caused by the drought and consequent famine of 1868-69 was much increased through the destruction of a great portion of the remaining crops by the locusts. In the Dera Ismail Khan district flights from the Suliman Range appeared in the end of April and in May; eggs and young locusts were also found, about this date, near the hills in the sandy tracts of the same district. Flights were also reported in the early part of May from Amritsar. But throughout Central Rajputana and in the more southern districts of the Punjab (Multan, Sirsa, Ludiana, Dera Ghazi Khan, Hissar) the main flights appeared about the commencement of the south-west monsoon in June and July. The eggs laid by the invading flights were distributed throughout the whole of Central Rajputana, and also in the Hissar district of the Punjab, and the young locusts became full-grown and acquired wings in August and September, and were said to have been the progenitors of the second batch of eggs which were laid about the end of September in the Hissar district. The crops were damaged, in the first instance, by the young locusts before they acquired wings, and afterwards by the winged swarms which seem to have flown about the whole of North-West India throughout the autumn and winter of 1869 and settled at intervals to devour the crops. Records have been found of measures, such as trenching, &c., which were adopted with considerable success in the Hissar district in the Punjab and also on the Deesa Commissariat Farm in Rajputana, for the destruction of the young insects in their wingless stage; while from Amritsar and Lahore there are accounts of how the villagers collected with tom-toms and drove the winged locusts off their crops, so that but little damage was done. Throughout Rajputana, however, the measures taken for the destruction of the pest seems to have been very much less successful, partly perhaps because they were carried on unsystematically, but chiefly no doubt because of the vastness of the numbers of locusts by which the country was invaded and the comparative sparseness of the population. Thus a vast amount of injury was done in Marwar, Ajmere, Kishengarh, Tonk, Sirohi, and the northern part of Meywar, the crops being damaged both by the young locusts and also by the winged flights.

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* The steam ship *Euphrates* was said to have had to plough her way through locusts for three days and nights in the Red Sea towards the end of October in this year (Swinhoe), but there is no evidence to show to what extent the invasion was a general one in the intervening countries.

The following extract from a report, dated 9th December, 1870, by Colonel J. C. Brooke, Officiating Agent to the Governor-General in Rajputana, shows the extent of the calamity :—

"A breadth of land equal to half the usual quantity was sown. The grain everywhere sprouted splendidly, and all reckoned that the famine had passed, when another scourge visited the country in the shape of locusts. They entered Marwar from Jeysulmere at the end of May and laid their eggs in every direction. These hatched as the rains set in, and by the end of August the young locusts had spread over the whole famine tract, laying fresh eggs wherever there was sand. The broods from these eggs appeared early in September and, moving in dense masses backwards and forwards, destroyed every living thing in their way. Crops were eaten down, so that the ground had the appearance of never having been sown. By degrees the locusts got their wings and flew hither and thither over the country, devouring the ripening grain which the young broods had spared. Each swarm, of which there must have been hundreds in Rajputana, settled every night, covered every green plant over an area of 12 or 15 square miles, and left it bare as they flew away in the morning. The loss to the country by the locusts was about 75 per cent. of the crop, which originally was only half a crop.

"Usually locusts confine their ravages to Marwar and Bikanir, but in 1869 they spread over Ajmere, Kishengarh, Tonk, and the northern part of Meywar. The same complaint was everywhere heard that the locusts had destroyed from one-quarter to three-quarters of a splendid harvest, and that another year of famine, though not so bad as the former, had to be endured.

"Marwar suffered most, and many villagers, especially in the north, were again compelled to emigrate. They were now in much more reduced circumstances than previously. They flocked to the Ajmere poorhouses for relief, but would not take work. Those that remained in Marwar supported themselves on the bhoorut grass (*Achyranthes aspera*), which now gave a means of subsistence to all who would take the trouble to collect it . . . .

"The rains commenced at Tonk most auspiciously. Wheat at this time had risen to seven seers, and barley, the cheapest grain, to nine seers the rupee. Saving the high prices, all went on prosperously till the locusts came. The first flight appeared at the end of July, but did not do much harm. They deposited their eggs in the few dry sandhills in Tonk and in the sandy beds of the rivers. Intermediately the heavy rains had commenced, and the Bunass river rose to its brim and flowed down a muddy torrent 500 to 1,000 yards in width and 30 to 40 feet deep. After it had subsided, during a break in the weather, when the usual time for hatching had arrived, the young locusts, about the size of small ants, issued from the sands of the river in myriads and at once formed their phalanxes to go forth and devour the land. They swam the deep pools in the rivers, they escaladed the walls of Tonk, entered the city, and took possession of the town and of every house—literally driving out the inhabitants. They cleared the land of its crops and committed great devastation throughout the country. When they had got their wings, sundry flights which were moving about settled and destroyed what previous ones had left. This visitation intensified the calamity of famine. The price of grain rose with the destruction caused by the locusts. In July and August, 1869, wheat was 6½ and barley 10½ seers per rupee. In September wheat was 6 and barley 7 seers; in October they were 5½ and 6½ respectively, and only in November did they begin gradually to fall."

In 1870, eggs laid by the cold-weather flights of the previous year hatched in March in the Jhelum district, and the young wingless locusts did some damage to the *rabi* crops. The people did what they could to prevent the winged locusts from alighting, and afterwards destroyed the young by trenching. In the beginning of July of this year, locusts appeared in the Hissar and Amritsar districts. There is no record of what became of the Hissar insects, but in Amritsar, according to the district report, they did a little damage to the crops, and young wingless locusts appeared in the end of August and early part of September, but were all destroyed

In 1872, in the Punjab, locusts were reported in July and August from Rohtak, Multan, Bannu, Jhelum, Dera Ghazi Khan, and Hissar. Eggs were laid in Rohtak in the early part of July, and young hatched out in Rohtak and Jhelum at the end of the month. The Dera Ghazi Khan district, however, is the only one in which any damage was recorded. In Rajputana a flight was recorded by Surgeon-Major Moore to have passed over Sirohi on the 31st of May of this year. According to Surgeon-Major Hendley's report vast flights appeared in August in Marwar, and great numbers of young hatched out about the end of August or beginning of September, occasioning "much damage" to the crops.

In 1873, flights were reported in the Jhelum and Amritsar districts, eggs being laid and some damage done to the crops. In the Amritsar district the villagers are said to have followed the flights and destroyed all the eggs and young locusts that could be found.

In both 1876 and 1877, locusts were observed about July in the Hissar district. In 1878, besides being reported from Rajputana, they are noticed in the district reports as having appeared in Dera Ghazi Khan in May and in Hissar in the end of June.

In 1879, according to a notice in the Proceedings of the Entomological Society of London, locusts appeared early in March near Meerut, covering a tract of country about 15 miles long by 2 or 3 miles broad, and gradually moving northwards up the Anupshahr branch of the Ganges canal. They laid eggs over the whole area, and before the end of the month the ground was covered with little black larvæ. Considerable damage was done to peas and mustard, but not much to the grain, which was then being cut. In the district reports also locusts are noticed in this year in Hissar, coming from the Rajputana desert in April and again in July, as well as in Dera Ghazi Khan, where damage was done in September.

In 1880, in July and August, flights appeared in the Dera Ghazi Khan district and did much damage to the *kharif* crops. Considerable damage was done about this year in Jeypur by a large flight recorded by Surgeon-Major Hendley, who also writes that the trains on the Rajputana-Malwa Railway found it difficult to proceed owing to the rails being made slippery by the dead bodies of the locusts. A flight also, which may have belonged to the species under consideration, though other locusts also visit the district, appeared in Jullundur in April, 1880, and deposited eggs, which were all destroyed by the people.

Sources of information.

The reports, out of which the foregoing account has been pieced together, have been too numerous for individual reference in the text. The majority of them have been furnished through the Central Agricultural Department, the Directors of Land Records and Agriculture of Bombay, the Punjab, North-West Provinces, and Bengal, the Board of Revenue, Madras, and the Agent to the Governor-General in Rajputana. The dates of appearance of many of the swarms have been taken from the Crop and Weather Reports issued by the Local Governments. The following is a list of the chief sources of information:—Reports, in most cases accompanied by specimens, from the District Officers of Agra, Aligarh, Allahabad, Amritsar, Azamgarh, Bahraich, Banda, Bara Banki, Bareilly, Basti, Bijapur, Bogra, Broach, Cawnpur, Chittagong, Cuddapah, Dacca, Dera Ghazi Khan, Dera Ismail Khan, Etah, Etawah, Farukhabad, Fatehpur, Fyzabad, Garhwal, Gonda, Gurgaon, Hamirpur, Hardoi, Hissar, Jhansi, Jaunpur, Jalaun, Jhelum, Jullundur, Karachi, Kheri, Kistna, Kohat, Kumaon, Kurnool, Lahore, Lalitpur, Muttra, Muzaffargarh, North Arcot, Partabgarh, Peshawar, Poona, Rae Bareli, Rajshahye, Ratnagiri, Rawalpindi, Rungpur, Sambalpur, Shahjahanpur, Shahpur, Shikarpur, Sholapur, Simla, Sukkur, Sultanpur, Tarai, Unao, and Vizagapatam; the Acting Political Agent, Mahi Kantha tract, Bombay, the Political Agent of Haraoti and Tonk, the Forest Officer in charge of the Bashahr Division, the Manager of the Jeypur Estate, the Chairman of the Fureedpur Municipality, the Political Agent, Aajpipla State, the Political Agent, Bikanir, the Secretary to the Musahibala, Marwar, the British Agent in Shiraz, the Resident in Lingah, the Residency Agents in Bahrein and Shargah, the Coal Agent, Bassidore, the Secretary to the Municipal Committee, Amritsar, the Superintendent, Government Horticultural Gardens, Lucknow, the Superintendent of the Government Central Museum, Madras, Colonel E. C. Ross, Major C. A. R. Sage, Captains H. A. Deane and Barham, Surgeon-Majors Ross and Hendley, and Messrs. F. W. P. Macdonald, W. Coldstream, W. Haxworth, W. D. Cumming, G. H. Kearney, C. F. Elliott, J. Cleghorn, M. Donaldson, R. Blechynden, and B. C. Bosu.

Reference has also been made to Hunter's Gazetteer, and to reports, in the Proceedings of the Revenue and Agricultural Department, by Surgeon-General W. Moore, Lieutenant-Colonel Swinhoe, Lieutenant-Colonel Bradford, Colonel J. C. Brooke, and Mr. Henvey; also to a report on the rainfall in Rajputana, furnished by the Meteorological Reporter to the Government of Bengal.

E. C. COTES,
Indian Museum, Calcutta.

The 1*st December*, 1890.

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MISCELLANEOUS NOTES.

No. I.—SHINGLE AND SHELLS FROM THE BEACH AT UMBARGAUM.

HERE in Bombay we are accustomed to expect only trappean pebbles on the shore, or, if we find a bit of sedimentary rock, to refer it to "ballast from some boat," and this one degree and more to the north and south of the harbour.

was therefore interested in finding at Umbargaum, near Damân, the volcanic shingle almost replaced by very different materials and collected a pocketful of all sorts.

It will be noticed that the nice pebbles are mostly of sandstone grit or breccia, and that they seem mostly to be of recent and contemporary formation, though of very various character.

There are many pieces of concretionary limestone (or kankar), which seem to have been formed on vegetable nuclei, and one or two pieces of sandstone present the same appearance. A few volcanic pebbles appear; and a fragment of pumice bears witness to the great eruption of Krakatoa in 1883, which covered the Indian seas with that material for two years after.

I have omitted to preserve a fragment of Welsh slate, and one of coal which bore witness to the presence of civilized man, a bone of a whale, and some lumps of Madrepore, much more abundant than hereabout; but I include a couple of half-petrified oyster shells. The neighbouring soil is sand, mostly wind-blown, overlying beds of recent sandstone, breccia, and conglomerate. These again rest upon trap reefs.

The molluscs of the beach seem to be much the same as here; but the *Muricidæ* are better developed, especially a *Fasciolaria*. *Placena placenta*, the Window Pearl Oyster, common near Bombay, is not present, nor is any trace of *Solen*. Boring bivalves appear to be very common: two pebbles in every three are drilled by them. The dead shells observed were all of *Pholas;* but probably there are other genera, and their abundant presence is presumably due to that of sedimentary rocks, more workable than basalt.

W. F. SINCLAIR, Bo. C. S.

Tanna, April, 1891.

II.—LEAF WEEVILS.

I AM sending you a few specimens of oak leaves (*Quercus incana*) rolled up by a kind of weevil, one or two of which I also send for identification.* Their method of working may be of interest.

The beetle first cut across the leaf, at about ½ an inch from its base, from the outside edges to the centre rib, and this too she cut partly through, I presume, in order to stop the sap running up the leaf and so preventing further growth. She then walked all over the upper side of the leaf and appeared to me to be eating the soft whitish powder that lies on a young oak leaf, but possibly she might have been applying some gummy substance to the surface of the leaf, as soon after she folded the leaf together along the rib, the upper side of the leaf inside.

She then commenced rolling the leaf up. To do this she placed herself on the rib of the leaf with her head towards the base, and worked with her legs sideways to the right and upwards, every now and then crossing over to the outer edge to push in with her mouth any refractory projection that would not roll smoothly.

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* A species of *Apoderus* of the family *Curculionidæ* (identified through Mr. L. de Nicéville, Hon. Secy., Insect Section).—*Editor*.

Having rolled up the leaf three or four turns, she then bit a hole in it as deep as her head and neck would allow, and then in this hole she deposited an egg.

She then recommenced the folding of the leaf and rolled it up till she reached the cut.

The insect I watched only laid one egg, but I have found some leaves with two eggs in them. The eggs appear to take ten days to a fortnight to hatch into the grub which feeds on the leaf inside the roll.

C. A. R. SAGE, Major,
2nd Goorkhas.

Dharsala, May, 1891.

III.—THE TEMERITY OF RATS.

NUMEROUS stories have been told of the temerity and impudence of rats when in search of food, but I have not heard of any similar to my late experience.

My house is overrun with rats, and I find that traps and "Rough on Rats" do not seem to have any effect. The rats demolish skins, braces, whips, &c., and one night I awoke, feeling a rat gnawing at my toes: of course I kicked him off on to the floor. I may mention that this happened in spite of a dog (a good ratter) being in the room. A few days ago I was watching my pony being shod, and noticed the hoof apparently cut away all round the coronet, wherever it was soft. I accused the *nalband* of doing this in addition to the usual rasping of the hoof to suit the shoe. The syce then told me that the rats had done it, and that they came at night and ate away not only the pony's hoofs but those of the goat and kid, and that these animals were greatly tormented by the rats. I examined the hoofs and found beyond doubt that such was the case, the marks of the teeth being plain ; and, moreover, I found that the horns of the kid, which had been about ½ an inch high, were eaten flush with the head. Next morning too we found a large rat in the bedding under the horse, evidently killed by a kick from him.

R. LIGHT, Captain.

Aden, May, 1891.

IV.—*DALBERGIA SPINOSA.*

(Read at the meeting on 1st *July*, 1891.*)*

As far as I am aware, *Dalbergia spinosa*, a plant belonging to the N. O. *Leguminosa*, has not yet been included in the catalogue of plants indigenous to the Bombay Presidency. It is said to grow on the shores of the Eastern and

Western Peninsulas, and in Chittagong. Three years ago I met with a plant of this species at Mulleachevad about 4 miles from the shores of Radi, and lately another at Majgaum, a village about 17 miles inland. Its characters correspond exactly with those given in the *Flora of British India*. Roxburgh in his *Flora of India* states that the fruit of this species is one-seeded, but in the specimens examined by me, the fruits were sometimes two-seeded. Neither Graham nor Dalzell and Gibson make mention of this species. It flowers in May, and bears fruit at the end of the rains. The flowers appear, as in many other *Leguminosæ*, while some of the dry fruits are still upon the plant. The wood is of too small a size to be of any extended economic use; it is strong, hard, close-grained and slightly elastic; the annual rings are not distinctly marked. The cattle are very fond of the leaves, so that the lower branches within their reach are often naked and bare.

Dr. Watt, in his "Dictionary of Economic Products of India," gives, on the authority of Kunth, the following properties of this plant:—"The roots powdered absorb alcohol, and a spoonful of the powder in a tumbler of water is said to be sufficient to destroy in less than half an hour the effects of alcohol even in cases bordering on *delirium tremens*. The wood is soft, beautifully silvery white, close and straight grained." I have not had any opportunity to verify the use of the root, but the hard wood found even in small branches is neither soft nor silvery white, on the contrary it is very hard and dark brown, with darker longitudinal veins resembling very closely that of the sissoo.

This plant brings the total number of indigenous species of the important genus *Dalbergia* to 10, out of which 4 are trees: *D. sissoo*, *D. latifolia*, *D. lanceolaria*, and *D. paniculata*, all of them being valuable timber trees, the first two yielding the blackwood of Bombay. One, a shrub, *D. spinosa*. 5 climbers, *D. sympathetica*, *D. notubilis*, *D. confertifolia*, *D. Stocksii*. and *D. monosperma*. It would be seen that *D. spinosa* forms a connecting link between the trees and the climbers.

Specimens of leaves, flowers, fruits, and wood of *D. spinosa* are forwarded for the Society's herbarium.

D. G. DALGADO.

Sawantwady, *June*, 1891.

V.—THE DESTRUCTION OF LIFE BY WOLVES IN THE HOSHANGABAD AND NARSINGHPUR DISTRICTS.

In the Supplement to the Central Provinces Gazette, 6th June, 1891, Colonel K. C. E. Ward, C.I.E., Commissioner of the Nerbudda Division, while forwarding Mr. Playfair's Memorandum on wolf-killing operations in that district, to the Chief Commissioner, Central Provinces, reports as follows:—

In consequence of the depredations which wolves were committing in this Division, Mr. Playfair's services were placed at my disposal in your No. 778-41.

dated the 9th February, 1891, and soon after that date he reported his arrival to me, and finally closed his operations at the end of April. During this period he submitted weekly reports of his action, and the Chief Commissioner was regularly kept informed of their contents.

In the Narsinghpur District there were 23 persons killed and 20 wounded, and in the Hoshangabad District the loss of life was reported to be 95 persons. 13 large wolves and 25 cubs were destroyed; of these, 6 wolves and 15 cubs were disposed of before Mr. Playfair commenced operations, and 7 wolves and 10 cubs were destroyed under Mr. Playfair's supervision. The expenditure incurred by Mr. Playfair in rewards for the animals destroyed and other incidental expenses amounted to Rs. 254-9-0.

There have been no deaths reported since the 13th March, so that we may fairly hope that the action that has been taken in the direction of wolf-destruction has rid this part of the country of a dangerous scourge. There is still one she-wolf left in the Bankheri circle, but I hope that it may be destroyed before the rains by the people who are now looking for it.

MEMORANDUM ON WOLF-KILLING OPERATIONS IN 1891.

SINCE the beginning of August, 1890, wolves appear to have taken to killing children in the District of Hoshangabad, and when the Dhoodhee river became shallow they appear to have crossed and carried on their depredations in the Narsinghpur District, but chiefly in the Sainkheri Out-post circle bordering the Hoshangabad District.

The cause of their having turned man-eaters is difficult to assign. People say that it was probably due to their having eaten the corpses of people who had not been sufficiently deeply buried. It is well known that wolves frequently kill children up-country, but not in the wholesale manner they have done in Hoshangabad.

The one great difficulty in hunting down the wolves is the inability to find any clue to their retreats, and the distances travelled by them after committing any depredations. They generally lie in the open in "Dal," Hemp or "Jowra" fields and in little patches of Babul or Mowa jungle, but they do not keep to the same spot, but frequently move. Before they took to man-eating, a pack of seven or eight used frequently to be seen in the Anjun river by villages Deori and Oodeypur, and little children could drive the whole pack away, but since August they have become more erratic in their movements. Except when they have their young and are driven to it through fear, they do not live in holes; and in the case of the Kookurpa cubs the mother used to go into the hole and feed the young ones, while the old male apparently remained outside. Their staple food appears to be goats and young ponies, and they are said by people not to eat carcases of animals, but this I think requires modification, as I have heard instances to the contrary from good authority.

The pack with which I have been concerned is said to have originally consisted of 7 or 9 wolves, and sometimes only five were seen to make attacks. From the manner in which the wolves killed, I think that one pack occasionally split up and killed in different directions, meeting again afterwards. Like jackals, they collect by call.

During August, September, October and November kills were almost entirely confined to the Bankheri Station-house circle and the Oomerdha and Piparia Out-post circles, but were comparatively few in the latter.

From the 1st to the 17th December the kills seem to have occurred west of Piparia and Bankheri, and after that date until the end of December in the Bankheri circle. Then, curiously enough, the wolves appear to have run right away east to the Jubbulpore border in the Narsinghpur District, along the main road to Jhansighat, steadily killing on their way at every 10th or 12th mile.

I was on the 16th February, 1891, placed on special duty by the Chief Commissioner to hunt down these wolves, and, after a preliminary visit to Narsinghpur, commenced operations. Up to that time 25 cubs had been caught, but the depredations continued. Having made myself acquainted with general facts as now described, I considered it impossible to cover as much ground as that in which kills occurred, so I confined myself to a tract of about 100 square miles in the Bankheri Station-house and Sainkheri, Oomerdha and Piparia Out-post circles. I personally visited most of the villages in all these circles, with a view to making myself known to the people and getting assistance from them. Having engaged the help of malguzars and kotwals, I arranged—

(1) that pits should be dug in every village;

(2) that early information of any kill should be given to me at once;

(3) that when a villager saw a wolf he should follow it up quietly from a distance and inform the malguzar of the village. The malguzar was then to surround the animal and send off information to me.

(4) I also stationed Shikaris in selected spots where from the kills I thought it likely they would meet the wolves, and I also had the carcases of animals killed by wolves poisoned through the Police.

Plan 1 was a complete failure; the people opposed it, as several bullocks fell into the pits. The plan appears to be of use only in instances when the regular runs of wolves are known. Kotwals generally carried information quickly, but villagers appeared too frightened to do anything beyond letting the animal disappear and then mention the fact on return to the village at night.

Plan 4—poisoning—is no doubt the most effectual. It is true that it takes a lot of poision to kill a wolf; but a moderate dose sickens him and gives one an opportunity of coming across him somewhere round about his kill. This was no doubt why I managed to get near the first two wolves shot in the open.

One other plan occurred to me at the close of operations, the result of which

I had not time to see. It was to build, in whatever village herds of goats were, pens some distance from the village and keep the goats in there at night, with a good Shikari sitting up over it. The smell of the goats will attract the wolf, who in attempting to take his prey should be shot.

The most effectual, but at the same time the most difficult plan, is to surround a tract of country to which wolves have been tracked, stop the holes in it and beat it as one would for game. This cannot, however, be left to the people or malguzars, as they have no idea of working together, and apparently take little interest in the *hank* until the animals are surrounded at the finish. Every mile or so should be supervised by a Government official, and every man should be shown his place, and instructions given him some days before *hank*. By means of beats of this kind I secured several wolves.

I would also state that the ordinary village Shikaris, who occasionally shoot fish, are also useless. The only persons of any use are those who really have a liking for sport, and who will work all day and not come back discontented from a blank day.

I think every inducement should be made to get wolves killed off as much as possible, and in circles where they are abundant their kills should be poisoned. They are useless animals for sport, and though as a rule they do not do much harm to human life, yet when they do take to killing people they are difficult animals to get at, whereas in their ordinary state they can be easily approached. Shikaris should be warned that when they come across any holes containing wolf cubs, they should first kill the parents and then catch the young.

From August to the 28th February, 6 wolves and 15 cubs were disposed of, and from March last, when I began operations, to the 25th April, 7 wolves and 10 cubs have been accounted for. It may be said that the pack which committed these depredations is now destroyed.

H. A. PLAYFAIR,

24th April, 1891. District Superintendent of Police.

VI.—THE MIGRATIONS OF BIRDS.

The migrations of birds have of late attracted a great deal of attention in Europe, and the subject gains in interest with every accession to our knowledge of it. In this country unfortunately Ornithologists have as yet been too much occupied with the identification, or discrimination, and distribution of species to give much attention to their wanderings. I do not refer only to the annual arrival and departure of those "upper classes" which winter in a warm climate and summer in a cool one; but to those periodical migrations from the hills to the plains, or from one district to another, which so many birds make for reasons at which we can only guess. An example which will suggest itself to every Sportsman is that of the Florican. Others, hardly ever noticed, but more curious, are at our doors. I will mention a few.

The familiar green Bee-eater (*Merops viridis*), which is not generally regarded as a migrant, disappears from Bombay about the beginning of April, and does not return till the end of the rains. On the coast of Canara it stays later and breeds, but disappears before the rains commence. I do not know where it goes.

The Redbacked Shrike (*Lanius erythronotus*) also disappears from Bombay and I think from Poona too, during the hot season and monsoon. I never found a nest in either place. In Canara it is not generally a common bird, and I cannot say with certainty whether it goes away for the monsoon, but it stays till May at least and breeds.

The common Kite disappears from Karwar entirely from the middle of May till about the end of September, and allows us to rear our chickens in peace. In 1889 one ragged, loaferish individual (probably an invalid) tried to stay; but it has not repeated the experiment. I believe that the majority of Bombay Kites also retire to some drier region during the monsoon, but many remain. The White-headed, or Brahminy Kite, being half a waterfowl, braves the rain.

Of the seven kinds of Drongos which are found in Canara, six breed on the coast. The Hair-crested Drongo, or Hairy Hottentot (*Chibia hottentota*), disappears during the breeding season. I have no idea where it goes.

On the other hand, some birds which are supposed to be migratory are not truly so, though they may wander a good deal, and attract more attention at one season than another. The little green Lovebird (*Loriculus vernalis*), which Barnes speaks of as a "cold weather visitant," may be found in the monsoon not ten miles from Bombay. On the coast of Canara it is very common at all seasons, but owing to its small size, green colour, and peculiar habits, it easily escapes notice. In December and January it gets noisy, and I suspect that at that season it is breeding; but no one appears ever to have found its nest, and I can get no information from natives about it.

All lovers of birds would like to know more about their periodical movements, and the reasons for them, but very little information can be collected by any single individual, however observant. What is required is that observers in all parts of the country should combine to take notes and compare them. No great knowledge of ornithology is required. For example, everybody knows the common Kite. The only bird which can be confounded with it is a young Brahminy Kite, and to distinguish these two at a glance you have only to remember that the tail of the Pariah is *always forked* and the tail of the Brahminy rounded.

Now I can assert with some confidence that there is not, at present, one Pariah Kite in Karwar or its neighbourhood. Two months ago there were hundreds. If one or two men in Bombay, one in Belgaum, Dharwar, or Sattara, one or two in the Nasik district, one or two in Guzerat, and so on, would keep their eyes upon the Kite population about them, and at the end of the monsoon collate their observations, we should soon know where the nuisances go. The same thing might be done with other common birds. This is a work which I think the B. N. H. Society is peculiarly qualified to carry out. Let the Ornithological Committee invite the co-operation of all members who are known to take an interest in birds, and make out a short list of species to be kept under observation. I am sure there would be a hearty response from many quarters, and the result would be of value to the whole ornithological world.

E. H. AITKEN.

Karwar, 20th June, 1891.

VII.—*ALOCASIA MACRORHIZA.*

(*Read at the Meeting held on* 1st *July*, 1891.)

The specimen on the table is the infloresence of the large Aroid so common in our gardens, generally called in Bombay *Alocasia macrorhiza*, and described by Graham as *Caladium grandifolium*. Graham remarks that it seems never to flower. Being uncertain whether it might not have changed its habit of not flowering since Graham's time, I consulted Mr. Carstensen, who informs me that he has never seen it flower in the Victoria Gardens where there must be thousands of plants. A plant in my garden growing under the shade of a mango tree and left to itself has formed a thick stock about 18 inches in length and has flowered several times. If you examine the infloresence you will find that it agrees exactly with that of *Alocasia indica*, Schott., which is the plant which Roxburgh describes as *Arum indicum*, Lour., the *Man-kachoo* of Bengal, where the starch obtained from the stem is much valued as an article of diet for invalids, and the stems and small tubers which grow upon the rootlets are eaten by all classes. In Bombay the economic value of this plant appears not to be generally known, though I have met with some Brahmins who use it. Of course it requires to be cooked with the same precautions as other aroids owing to the irritating action of the numerous needle-shaped crystals of oxalate of lime which are present in all parts of these plants. Cooking and the addition of vegetable acids changes the form of the lime salts, and thus removes their irritating property. The method of cultivation followed in our gardens is probably the only reason that the plant does not flower; the long-naked stalk being unsightly is not allowed to develop. Roxburgh says it will grow from 6 to 8 feet in height, though seldom allowed to reach more than 18 inches in Bengal.

W. DYMOCK,

Bombay, 1st July, 1891. *Brigade-Surgeon, Retired.*

VIII.—DOUM PALMS IN INDIA.

(*Read at the Meeting held on 1st July, 1891.*)

Among other objects of interest, which attracted my attention during my visit to Baroda in October, a number of young palms planted in the public Park gave rise to some enquiries and further investigations, the result of which I now have the honour to lay before the Natural History Society, with the object of soliciting further information regarding the Indian Doum-Palm.

The palms referred to in the Baroda Park were in all respects very similar to our common Palmyra-Palm (*Borassus flabelliformis*), the principal difference being that the leaf-stalks were almost golden-yellow and armed with prominent, hooked spines, in the place of the very close-set and minute teeth that edge the leaf-stalk of the Palmyra-Palm, and that a few of the plants, being, I presume, 5—6 years old, were commencing to bifurcate. The plants were all seedlings from the Doum-Palm growing in a wild or at least naturalized state at the Gaekwar's possessions near Oomrad in Surat. They, however, appeared to me to widely differ from the well-known specimens of Doum-Palm in the Sewree Cemetery, and still more from seedlings in the Victoria Gardens raised from seeds obtained from Aden. Mr. Hardy, Assistant Engineer in Bhavnagar, had informed me of the occurrence of branching palms in Mahuva near the sea in the Bhavnagar State, and has kindly sent me photographs of two of the largest specimens. He writes, "I think they are wonderfully graceful. From one stem four main branches rise, each of which again branches into two (and two only) even up to the tiny twigs, which are not as thick as a finger. There are several about, and I am sending the photos of the best specimens that I have seen. The villagers call them '*Rawun Tadd*,' Rawun being the name of one of their gods, who had a lot of arms." At my request for further particulars and specimens of leaf, flower and fruit, he kindly forwarded the specimens now laid on the table, and writes :— "I am sending you the leaf, fruit, and flower of a male and female branching palm. The height of the larger one, whose photograph I sent you, is 58 feet. The main stem measures 19 feet round, and the circumference of the 4 trunks that branch from it are 5 feet 9 inches, 5 feet 9 inches, 5 feet, and 4 feet 9 inches. The other one is 50 feet in height, the main trunk 14 feet 10 inches round, and its two stems 4 feet 2 inches and 5 feet 4 inches in circumference. They are both according to the villagers about 180 years old. The female palm is much the same to look at, and grows in a neighbouring field. Some months ago, Mr. Henry, the Superintendent of Public Gardens, Baroda, kindly sent me seeds of the palm in the Baroda territory, and from the appearance of these, as from the similarity of the leaves sent, to those observed in Baroda, I feel convinced that the palms in both localities belong to the same kind, and are different from the tree at Sewree and the seedlings of seeds from Aden.

The literature at my command is very limited regarding references to the different species of this genus *Hyphœna*. Bentham and Hooker's *Genera*

Plantarum gives a full description of the genus, under which it is remarked that 9 species are known as inhabitants of Tropical Africa, Arabia, and Madagascar. Gærtner, in his "*De Fructibus-et-seminibus Plantarum*," gives a description and illustration of the seed of *Hyphœne coriacea*, which in all respects corresponds well with the Indian form, and of the entire fruit of *H. crinita*, which corresponds with the Sewree form. Baron Ferd Von. Mueller in his *Select Extra-tropical Plants* mentions the following kinds : *Hyphœne Argun*, Mart., Nubia to 21° N. L. ; *H. coriacea.*, Gœrtn., Equatorial Eastern Africa, the dichatomous Palm of the sea coast regions. It attains a height of 80 feet ; *H. crinita*, Gœrtn. (*H. thebaica*, Mart.) The ginger-bread palm or Doum-palm ; Abyssinia, Nubia, Arabia and Egypt, as far as 31° N. L. and southwards to the Zambesi, Nyassa and Sofala. In Arabia to 28° N. L. (Schweinfurth.) up to the plateau of Abyssinia (Drude). It is much branched, and attains a height of about 30 feet. The mealy husk of the fruit is edible. Grows away from the sea. *H. ventricosa*, Kirk, Zambesi, loftier than the other species, stem turgid towards the middle, fruit large.

Major Casati in his "Ten years in Equatoria" frequently refers to the Doum-palm, *Palma Doum*, in the first part of his book, evidently referring to *H. thebaica*, while having travelled further south and approaching the sea-coast he mentions *Cucifera* trees, evidently referring to another species (*Cucifera* is a synonym for *Hyphœne*), probably *H* *coriacea*.

The two or three species now before us are the wild Doum-palm from Mahuva and Oomrud and the cultivated Doum-palm from Sewree Cemetery and seedlings from Aden.

The first of these is distinguished by large fan-shaped, flat, simply folded-leaves, borne on strong yellow leaf stalks, edged with distant black hooked spines, by very large irregularly pear-shaped fruits, near the stalk furnished with two small protuberances, probably formed by the two undeveloped ovules, and thus approaching the allied 3-seeded *Borassus flabelliformis*. The rind of the fruit is reddish-brown, shining, warted, fleshy, and encloses a very thick layer of fibrous matter covering the kernel. The male catkins are long and whip-like, more or less bent, and generally appear in bundles of 2, 3 or 4, rarely more. This kind must probably be referred to *Hyphœne coriacea*, Gœrtn.

The species of which a male and female tree are found in the Sewree Cemetery is mentioned in the Supplement to Dalzell and Gibson's *Flora* under the name of *Hyphœne coriacea*, Sprg., and *H. thebaica* and *H. crinita* are cited as synonyms. It is stated to be the Doum-palm of the upper Thebaid, and so far fairly well corresponds with the scanty information contained in Lindley's Treasury of Botany, where a plate is given, which, however, is anything but a good illustration. The leaves of this plant differ from the preceding kind by the recurved midrib, giving the leaf a peculiar graceful shape, by the fibres between the divisions of the leaf being darker coloured, and by the hooked spines of the yellow leaf stalk being larger and less distant. The male catkins are straight, shorter than in the preceding kind, and generally appear in bundles of 4—9. The fruits are very numerous and closely set, irregularly egg-shaped, and not half the size of the fruits of *H. coriacea;* their rind is smooth and shining, when ripe reddish-brown, dotted, but not warted, and encloses a thin husk, in which the fibrous matter is freely mixed with an edible mealy substance. This kind is said rarely to attain a greater height than 25—30 feet. This species is undoubtedly the *H. crinita*, Gœrtn. (*H. thebaica*, Mart. of Egypt).

Finally, we have before us a leaf of a Doum-palm raised from seed from Aden. If this belongs to the same species, it is at least of a different variety from the Sewree trees. The leaves seem very different; they represent the same characteristic feature of the recurved midrib, but are considerably larger, their divisions thinner and more pointed, and their stalks perfectly green and destitute of spines. As this has not as yet flowered, it is, however, impossible to even approximately identify it as a third species.

In conclusion, I will only add that any information regarding the occurrence of Doum-palms in India will be most welcome and may tend to solve the question whether the Doum-palm is really indigenous or only naturalized by seeds having been washed ashore after having travelled across the seas from tropical Africa.

G. CARSTENSEN.

Bombay, 1*st July*, 1891.

IX.—A GALL ON *TAMARIX DIOICA*.

SOME months ago my attention was attracted to the occurrence of a white substance on the branches of *Tamarix dioica.* They at first appeared as small white spots of a sticky substance, and I thought them to be a kind of fungus. They, however, very soon increased in size and assumed a regular shape, and by examining them I found the sticky matter to contain a larva. They must, therefore, be considered to be a kind of gall. Now it is a well-known fact that several kinds of *Tamarix* in Sind, Afghanistan and Persia produce galls which furnish a kind of manna. The creamy nature of the galls in question seem to be very probable that they might furnish an edible substance. I should be glad if any of the entomologists of our Society could throw a little more light on this question.

G. CARSTENSEN.

Bombay, 1*st July*, 1891.

X.—A VARIETY OF *BUTEA FRONDOSA*.

IN addition to the information contributed by Mr. H. T. Ommanney* regarding his interesting sport, I may state that I noticed a single tree of this variety in the jungle behind "the Duke's Nose" at Khandalla in 1889, and was very much struck by its great beauty. Mr. Ommanney has kindly sent me seeds of this variety, so it is to be hoped that this variety will find its way into our gardens, though it is very questionable whether the seeds will reproduce the variety, though the fact that other plants belonging to the same N. O. *Leguminosæ*, such as the white-flowered varieties of *Arbus precatorius*, and of *Erythrina indica*, are reproduced from seed seems to promise success in regard to this variety also.

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* See page 107 of this Vol.

G. CARSTENSEN.

Bombay, 1st July, 1891.

XI.—A PANTHER EATING A PANTHER.

On looking through the Society's Journal, Vol. IV. of 1889, I see a letter from Mr. H. Littledale, dated September, 1889, headed "Bears being eaten by Tigers," which at the time escaped my notice, or I would have sent an account of what happened when I was down in Ceylon.

In 1883 I was living at Haldamulla, in the Ouvah district. My bungalow, being 3,300 feet above the sea, stood on the edge of a precipice and commanded a splendid view of the low country between Hambantota and Galle. Game was fairly plentiful: elephants, buffalo, panther, and sambhur could be obtained within eight miles of my bungalow, so most of my spare time was taken up stalking them, as "beating" was out of the question.

On the 17th June, 1883, I started about twelve o'clock, leading my pony down the hill for the first two miles, as it was too steep to ride. I then rode across a plateau and again led my pony down a path used by tabulum bullocks until I reached the Wellawa Gunga. This river I had to cross two or three times, after which the path alongside the river was good going until I reached my destination, a village consisting of two or three huts, called Nellwayao, 13 miles from Haldamulla. I arrived about 5 P.M. and immediately asked for my tracker, a Cingalese by name Keralli. They told me he had gone out to look for elephant tracks, so I had nothing to do but wait for his return: he came back about half-past seven, and I asked him what he had seen. He told me he had not come across any fresh tracks of elephants, but that as he was going up a dry nullah, about two miles off, and close to the place where I had killed an elephant a month before, he saw a panther come out of the jungle into the nullah, and immediately afterwards another, only larger, panther also appeared from the same side a few yards further up. Keralli hid behind a large rock and saw the larger panther attack the smaller one, and they both commenced fighting about fifty yards from where he was hidden. He took a shot with his rifle and hit the smaller one, which was underneath and seemed to be getting the worst of the fight.

Most of the Cingalese in the low country possess a gun of sorts, and in the dry weather sit up over water holes and on the banks of the rivers and pot deer when they come down to drink; and it is not an uncommon thing to meet them with half a dozen skins on their heads going to some village or town to dispose of them. I believe a license is necessary both for carrying a gun and also to kill sambhur, but the law seems to be very little in force in these parts, and consequently the game suffers to a tremendous extent. I have frequently heard five or six shots fired during the night within a mile or two of my camp.

Immediately after Keralli had fired, the panthers separated and returned to the jungles by the same paths by which they had approached the nullah, and Keralli thinking he had done enough, and that discretion was the better part of valour, especially as it was getting dark, came back to me. Not understanding Cingalese, the foregoing was interpreted to me by my servant, and Keralli, going through a pantomime while relating his adventures, made me grasp the state of affairs better than I should otherwise have done. At daylight next morning, there being no fresh tracks of elephants about, I decided to go and look up the wounded panther, as Keralli declared he was certain that he had wounded it. On coming to the nullah there were the marks of the scuffle shown quite plainly, and also the pug to and from the jungle. We then took up the tracts of the wounded panther, and a short distance up the bank came on blood. The jungle here was fairly open as regards trees, but the whole ground was covered with *nillao* about 3 feet high. "Nillao" is a sort of weed with a straight stem, and grows to a height of six or eight feet close together. It then dies, and it is very difficult to force one's way through it. It is said to flower once in seven years, when all the bees and jungle-fowl for miles round flock to it. We continued the tracking along the path through the *nillao* for about thirty yards when we came on a pool of blood and found pugs of the larger panther about—the two had evidently had another scuffle—and then continued together along the path for about twenty yards, where I came on the panther dead and a considerable portion of the hind quarters eaten. I examined it carefully without allowing it to be touched. It was a full-grown female panther in very poor condition; the carcase was quite fresh, and the other panther could have only left a very short time before we arrived. I left one of my men to put up a machan in a tree close by, and gave strict orders that the body was not to be touched, as I intended to sit up over it that evening, and then left with Keralli to see if we could find any elephant tracks. I may state that we looked carefully over the ground around the kill and could find no pugs of either jackal, pig or any other animals, except the two panthers, the pugs of which were quite distinct and very different in size. I got back to camp about 4 P.M., having come across no fresh tracks of elephants, and found the man I had left behind to build the machan awaiting me. He said that, having cut some sticks, he came back and found the dead panther had been dragged about fifteen yards further into the *nillao*, and that a large panther was standing over it, which slunk away on his approach. He then built the machan in a tree close by, and everything was ready. I had some food, and then started out with Keralli and a couple of men. On arrival at the place I found the man had, in order to save the carcase being carried further away, tied the forelegs together and driven a stake through into the ground, and had also cut the *nillao* down all round, so as to give me a better chance. I told Keralli and the two men to go back about a quarter of a mile down the nullah and remain there until they heard me shout to them. I then sat up in the machan until about nine o'clock, but as nothing appeared and there was very little moonlight, I shouted to the men, when to my astonishment and indignation they answered me back from the nullah about sixty yards off. On going to them I found they were sitting round a small fire they had lighted close under the bank and which I had not noticed, as I had been sitting with my back towards them. This, I have no doubt, accounted for the panther not putting in an appearance. I went back to camp in a very bad temper, and started at daybreak next morning for Haldamulla. I, however, sent Keralli out to look after the panther, and he came to me and reported that the panther had come back and pulled the carcase about fifty yards further into the jungle and eaten a considerable portion more of it, but he had not seen the panther. I should like to have got the other panther, to see whether it was a male or female, but I feel certain from the size of the pugs that it was male; and if I am correct in supposing it to be a male, the question arises, was the struggle that Keralli the tracker witnessed a fight between two hungry animals of the same species with the ultimate intention of the victor making a meal off the vanquished, or could it have been only a lovers' quarrel which, ending in death, had furnished the male with food?

E. L. BARTON.

Bombay, June, 1891.

XII.—A MAN-KILLING BEAR.

On the 24th May, 1891, Mr. E. L. Barton and I were encamped in the State of Dharampore, near the Nassick Frontier, where we had gone on a short shooting trip. About 9 A.M. on this day a man came running to our camp to say that a man had been badly wounded by a bear near a village five miles off, and that the bear had been marked down and surrounded by villagers in a jungle close by. We started off as soon as possible, and after a long ride up a hill, we came to the village where the man was who had been mauled. We found him sitting in a hut and examined him. We found half of his face torn away and hanging by shreds, his head deeply cut with a claw-wound, and his back also badly mauled by the bear's claws. We got some water, cleaned his wounds, and bound up his face with my pocket handkerchief. A desultory conversation then went on between various members of the crowd and the man's wife as to whether the man would live or not. There was a strong consensus of opinion that the man would live, in which, I may say, I never for a moment shared.

We then enquired into the facts. It appeared the man, with a little boy, was sitting or lying smoking a *beerie* on the ground near a path about 250 yards from the village in the early morning, and whilst so engaged a bear came behind him and at once, without any provocation, attacked him. The little boy ran off at once for assistance, and the bear, after severely mauling the man in the way I have mentioned, left him. Several men were near at hand, and they marked the bear with two cubs into a jungle close by, where she laid up for the day. Men got up trees all round this jungle, and there they remained till we came up. We went to the spot where the struggle took place, and then we saw the marks of the bear's feet on the ground; but this was not very plain, because a part of the struggle took place on sheet rock. There was a path from the village close by with trees growing about, forming a grazing jungle. The spot was on a table-land about 800 feet above the plain below, and close by was a thick jungle on the side of the hill, in which the bear and her cubs were fast asleep. I should say that the bear was making to this jungle for the purpose of spending the heat of the day therein, and that she saw this man in her road and at once went for him.

We had very little trouble in killing the old she-bear and her two $\frac{3}{4}$-grown cubs. We had a large number of beaters and the beat was arranged excellently, our trees being chosen with great judgment by our Shikari. Mr. Barton killed the old she-bear; he hit her well behind the shoulder and she ran into a *nullah* with her cubs, and there I had a shot at her also. The cubs kept close to her and we killed them both close to the mother.

The man died on the second day.

From inquiries we made we found this bear had, without provocation, in the last year attacked four or five other people in the neighbourhood and mauled them, but we heard of no one being actually killed by her. When we got her home and were taking her skin off, we found a bullet in her forearm surrounded by a thick sac of a tough sort of skin, and close by was a large splinter of bone about $2\frac{1}{4}$ inches long. The wound had quite healed up, but there was a deal of pus near that part of the bone from whence the splinter had come. It was evident that this splinter had been giving great pain to the bear, and to this I attribute its man-killing proclivities. The pain was probably always sufficient to keep the bear's recollection alive to the fact that the primary cause of that pain was attributable to man, and whenever a man came anywhere near, the bear's anger was aroused, in just the same way that a wounded tiger will always attack any one coming near him.

It has been frequently said that a bear always attacks a man's face when he goes in at him. If this is so, this is another instance of the correctness of this rule.

REGINALD GILBERT.

Bombay, July, 1891.

XIII.—PRICE OF TIGERS' SKINS, ETC. IN ENGLAND.

WHEN in England quite recently I went several times to Rowland Ward's shop in Piccadilly. They told me that they had just given the largest price that had ever been paid for a tiger's skin. It was a skin from Manchooria measuring over 13 feet, with thick deep wool on it like a bear. The price paid was £63, and the skin was not set up. I did not see this skin, but I saw and measured one in the shop which also came from Manchooria; it measured 13′ 4″ and had deep fur, more like the snow-leopard than any other animal I know. There was no bullet mark on it; and I was told that all the skins obtained from those parts are those of animals which had been poisoned. They had also in the shop two boars' heads which had come from Siberia; they were immense—bigger than those of any Indian boar. They were probably *Sus scrofa* and not our Indian species. The tusks were very thick, but I do not suppose the best out of the two pairs was 8″.

I was rather disappointed at the heads of Mr. Littledale's *Ovis Poli* in the Natural History Museum at South Kensington. He has about eight animals set up, but the biggest ram is not so large, I should fancy, as the head in our Society's collection. They told me also in Rowland's that they had had several *Ovis*' heads larger than Mr. Littledale's.

W. ST. JOHN RICHARDSON, Captain.

Poona, July, 1891.

PROCEEDINGS.

PROCEEDINGS OF THE MEETING ON 1st JULY, 1891.

THE usual monthly meeting of the members of this Society took place on Wednesday last, the 1st July, when Mr. W. E. Hart presided.

The following gentlemen were elected members of the Society:—Mr. W. C. Taylor (Orissa), Mr. J. Moray-Brown (England), Lieut. H. Wells-Coles (Bombay), Mr. P. H. Clutterbuck (Chanda), Mr. C. B. LaTouche (Bombay), Mr. M. D. Mackenzie, C. S. (Kurrachee), Surgeon-Major G. H. Gimlette (Sutna), Mr. F. E. Fletcher (Tellicherry), Lieut. G. Rippon (Upper Chindwin), Mr. E. Fulton, Bombay C. S. (Rangoon), Mr. Frank Chalk (Bombay), Dr. E. J. Lawder (Hyderabad), Dr. F. C. Barker (Rajkote) Lieut. S. H. Westropp (Bombay), Lieut. J. G. Westropp (Kolhapur), Major A. C. Bailward, R. A. (Bombay), Mr. Charles Maries (Gwalior), Mr. W. Robarts Hamilton (Bombay), Mr. R. T. Gibbs (Jhansi), Mr. R. A. Jenkins (Bombay), Dr. Govindrao Bhav Prabhakar (Bombay), and Lieut. C. D. Lester (Berbera).

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions:—

CONTRIBUTIONS DURING APRIL, MAY, AND JUNE.

Contribution.	Description.	Contributor.
2 Snakes	Typhlops brahminus	Mr. G. W. Vidal, C.S.
1 Vampire Bat	Megaderma lyra	Do.
1 Cobra (alive)	Naga tripudians	Mr. G. Carstensen.
A number of Fossil Bones.	From Gulf of Cambay	Mr. W. F. Sinclair, C.S.
1 Snake (alive)	Lycodon aulicus	Hon Mr. Justice Parsons.
2 Chameleons (alive)	Chamæleon calcaratus	Mr. J. A. Betham.
1 Snake (alive)	Ptyas mucosus	Dr. T. S. Weir.
A number of Sea Shells	From Tana District	Mr. W. F. Sinclair, C.S.
1 Wolf's Skin and Skull	Canis palipes	Mr. H. A. Playfair.
1 Squirrel's Skin	Sciurus Elphinstonei	Mr. J. C. Anderson.
2 Aracan Silver Pheasants.	Euplocamus cuvieri	Col. W. P. Symons, C.B.
1 Snake	Halys himalayanus	Mr. H. Lowther.
1 Panther Cub (alive)	Felis pardus	Mr. W. F. Hamilton
A number of Shells and Insects	From Mysore	Mr. W. Mahon Daly.
1 Pair of Buffalo Horns	26 inches in circumference	H. H. the Nawab Saheb of Junagarh.
5 Lizards (alive)	Uromastix Hardwickii Varanus bengalensis	Col. W. S. Hore.
1 Spotted Owlet (alive)	Carine brama	Mr. A. P. Pleader.
1 Large Aviary	Containing 21 Birds	Deposited by Mr. Geo. Ormiston.
2 Chameleons (alive)	Chamæleon calcaratus	Col. Wm. Scott.
1 Lynx's Skull	Felis caracal	Major G. E. Money.
A number of Fern Roots	Acteniopteris radiata.	Mr. S. B. Doig.
112 Birds' Skins	From North Canara	Mr. E. H. Aitken.
1 Monitor (alive)	Varanus bengalensis	Capt. Robertson.
A Collection of Butterflies	From Ganjam	Mr. R. T. Deane.
1 White-breasted Water Hen	Erythra phœnicura	Rev. F. Dreckmann.
1 Snake (alive)	Passerita mycterizans	Do.
2 Pied Crested Cuckoos (alive)	Coccystes jacobinus	Mr. H. Wenden, C.E.
1 Yellow-breasted Ground Thrush (alive)	Pitta bengalensis	Dr. J. Munday.
1 Wolf (alive)	Canis palipes	Mr. W. L. Harvey, C.S.
1 Gadwall (mounted)	Chaulelasmus streperus	Mr. C. Maries.
1 Red-crested Pochard	Fuligula rufina	Do.
2 Red-headed Merlines	Falco chiquera	Do.
A collection of Lizards, Scorpions, Centipedes	From Burma	Dr. C. T. Peters.
1 Pied Crested Cuckoo (alive)	Coccystes jacobinus	Mr. Vithal.
1 Snake	Passerita mycterizans	Mr. C. E. Kane.

CONTRIBUTIONS TO THE LIBRARY.

Memoirs of the Geological Survey of India, Vol. XXIV., Part III., in exchange.

Land Birds of the Pacific District (Belding), in exchange.

A Revision of the Cat Fishes (Eigenmann), in exchange.

Teratological Evidence as to the Heredity of Acquired Conditions (Windle), from author.

Journal of Comparative Medicine and Veterinary Archives, in exchange.

Journal of the Asiatic Society of Bengal, Vol. LIX., Nos. 4 and 5, in exchange.

The Victorian Naturalist, Nos. 11 and 12, in exchange.

The Canadian Entomologist, Vol. XXIII., in exchange.

Catalogue of the Ferns in the Herbarium of the Government of India at Saharanpur, from J. F. Duthie.

Pharmacographia Indica, Part IV., from Dr Dymock.

Memoirs de la Societé Zoologique de France, pour 1890, in exchange.

Proceedings of the Linnæan Society of New South Wales, Vol. V., Part 3, in exchange.

Proceedings of the Manchester Literary and Philosophical Society, 1890-91, in exchange.

Several large photographs of animals, from Mr. G. W. Terry.

EXHIBITS.

A Large collection of beautifully-executed sketches illustrative of the rarer birds found in North Cachar, by Mr. E. C. S. Baker, were exhibited and greatly admired. The Honorary Secretary stated that it was proposed to reproduce many of the plates in the Society's Journal, and that he hoped Mr. Baker, who was an excellent ornithologist, would contribute a series of papers in the birds of that region.

Mr. E L. Barton also exhibited a tiger's head and two bear' heads mounted by himself, which attracted much attention.

SUBSTANCES USED AS INCENSE IN THE EAST.

Dr. Dymock then read an exceedingly interesting paper on this subject, illustrating his remarks with specimens of Frankincense, Aloe or Eagle Wood, Benzoin or Benjamin, Usturak, Storax, Ammoniacum root (the Boi of the Parsees), Costus or Kust, Sandalwood, Common Camphor, Borneo Camphor (Baras), Cinnamon, Cassia, Deodar Wood, Dhupa, Himalayan Juniper, Himalayan Cypress, Morina coulteriana, Myrrh, Bdellium, Rala (or Dhuna), Sambrani, Vateria indica, Gokal dhup, Galbanum, and many others. The lecture will be printed in full in the Society's Journal.

The following papers were also read (in whole or part) at the meeting :—Doum Palms in India, by G. Carstensen ; the Butterflies of the Central Provinces (continued), by J. A. Betham ; Description of a Rare Fungus, by Dr. K. R. Kirtikar ; Note on Dalbergia Spinosa, by Dr. D. G. Dalgado ; Leaf Weevils, by Major C. A. R. Sage ; and the Temerity of Rats, by Capt. R. Light, all of which will be published in due course in the Proceedings of the Society.

THE PROTECTION OF WILD BIRDS AND ANIMALS.

The following letter has been addressed to Government by the Bombay Natural History Society on the subject of protection of birds and animals in the Presidency:—

From

The Honorary Secretary, Bombay Natural History Society,

To

The Acting Under-Secretary to Government, Bombay.

Sir,—I have the honour to acknowledge the receipt of your letter No. 1575 of 28th February last, containing draft rules, under section 25 (I) of the Indian Forest Act, proposed by Mr. A. T. Shuttleworth.

The Rules have been submitted to a large number of the members of this Society, and I am now instructed by the Committee to say that, in their opinion, the rules, if passed (with exception of Nos. 1 and 4), will be most unpopular and will prove a constant source of irritation and annoyance to everyone. The Committee of the Society have carefully considered the question from its various standpoints, and are strongly of opinion that the subject is of such importance that Government should pass a special Act with a view of establishing a "Close Season," during which *all indigenous wild birds and harmless wild animals* should be protected.

Considering the wanton destruction of birds for the sake of their plumage, which has of late taken place in many parts of the country, and which appears to be on the increase, the Committee are of opinion that protection should not be restricted to game, but should extend to all indigenous wild birds, as well as to harmless wild animals, and that a measure based on such liberal and comprehensive lines would meet with the approval and sympathy of Natives as well as Europeans.

In the meanwhile, the Committee of the Society would be glad to see all the forests in this Presidency closed for the monsoon months (say from 15th June to 15th October), during which time the majority of indigenous wild birds and harmless wild animals breed.

I beg to attach, in an appendix, several extracts from a large number of letters which have lately been sent to this Society from Sind and other parts of the country.—I have, &c.

H. M. Phipson, Honorary Secretary,
Bombay Natural History Society.

6, *Apollo Street*, 16*th April*, 1891.

Appendix.

" There can be no doubt that, unless some steps are taken to prevent it, the time is not far distant when the indigenous game birds of Sind will be well nigh exterminated in the more open parts of the country. Having had some experience all over this district, I know that the Black Partridge has decreased greatly in number, especially in the Rohri and Shikarpur districts. It was in the Rohri district that they were netted for their plumage in enormous numbers a few years ago. I believe the number was as mentioned by Mr. Symons—some 40,000. The shooting grounds about Mungrani, in the Shikarpur district, are now worthless. As regards other birds, a considerable traffic in plumage goes on in a quiet way, and one only occasionally hears of it. A year or two ago there was a great demand for certain feathers of the common paddy bird, for which Rs. 22 per "tola" were paid. As very few feathers from each bird are taken, and these small ones, the number of birds required to produce a "tola" weight of these feathers was considerable. I expostulated with the zemindars about it, but I heard that several men had made a good deal of money by slaughtering the birds for the sake of these few feathers. I do not think this sort of thing ought to be permitted."

* * * * * *

Sind, February, 1891.

"I am afraid the figures reported to you were anything but exaggerated. Seven or eight years ago it was rumoured that 80,000 Black Partridge skins had been sent off from one station in the Rohri Division (Shikarpur district). In this (the Eastern Nara) district large numbers of large blue Kingfishers and Egrets used to be killed, and last year I came across a band of Madrassees engaged in trapping Kingfishers. The awful destruction men of this class must cause may be imagined when it was worth their while to come every year this long journey from Madras, and they were able to pay all expenses and make a living out of the sale of the skins they procured in their cold weather tour."

* * * * * *

Hyderabad, Sind, Feb., 1891.

The above are extracted from a large number of letters received by the Society, all testifying to the rapid destruction of birds, &c., in various parts of the Presidency.

H. M. Phipson, Honorary Secretary.

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENTS of Accounts from 1st January, 1890 to 31st December, 1890.

Receipts.	Rs.	a.	p.	Expenditure.	Rs.	a.	p.
Balance on 1st January, 1890...........................	1,932	9	10	Rent of Rooms at 6, Apollo Street, from 1st December, 1889 to 30th November, 1890, at Rs. 100 per month	1,200	0	0
Subscriptions for 1889 (in arrears)...Rs. 135 0 0				Salaries from 1st December, 1890 to 30th November, 1890	1,104	0	0
Subscriptions for 1890 .... ,, 6,130 0 0				Furniture Account	129	10	0
Subscriptions for 1891 (in advance) ,, 325 0 0				Printing Journals and Coloured Plates from England..	3,541	7	3
Subscriptions for Journal only...... ,, 89 10 0				Printing and Stationery	488	15	6
	6,679	10	0	Library Account	80	0	0
				General Expenses..	1,520	2	2
Entrance Fees	730	0	0	Balance in Bank on 31st December, 1890	1,514	10	10
Miscellaneous Receipts	266	3	11	Cash with the Honorary Secretary on 31st December, 1890	29	10	0
Total......Rs.	9,608	7	9	Total......Rs.	9,608	7	9

Examined and found correct.

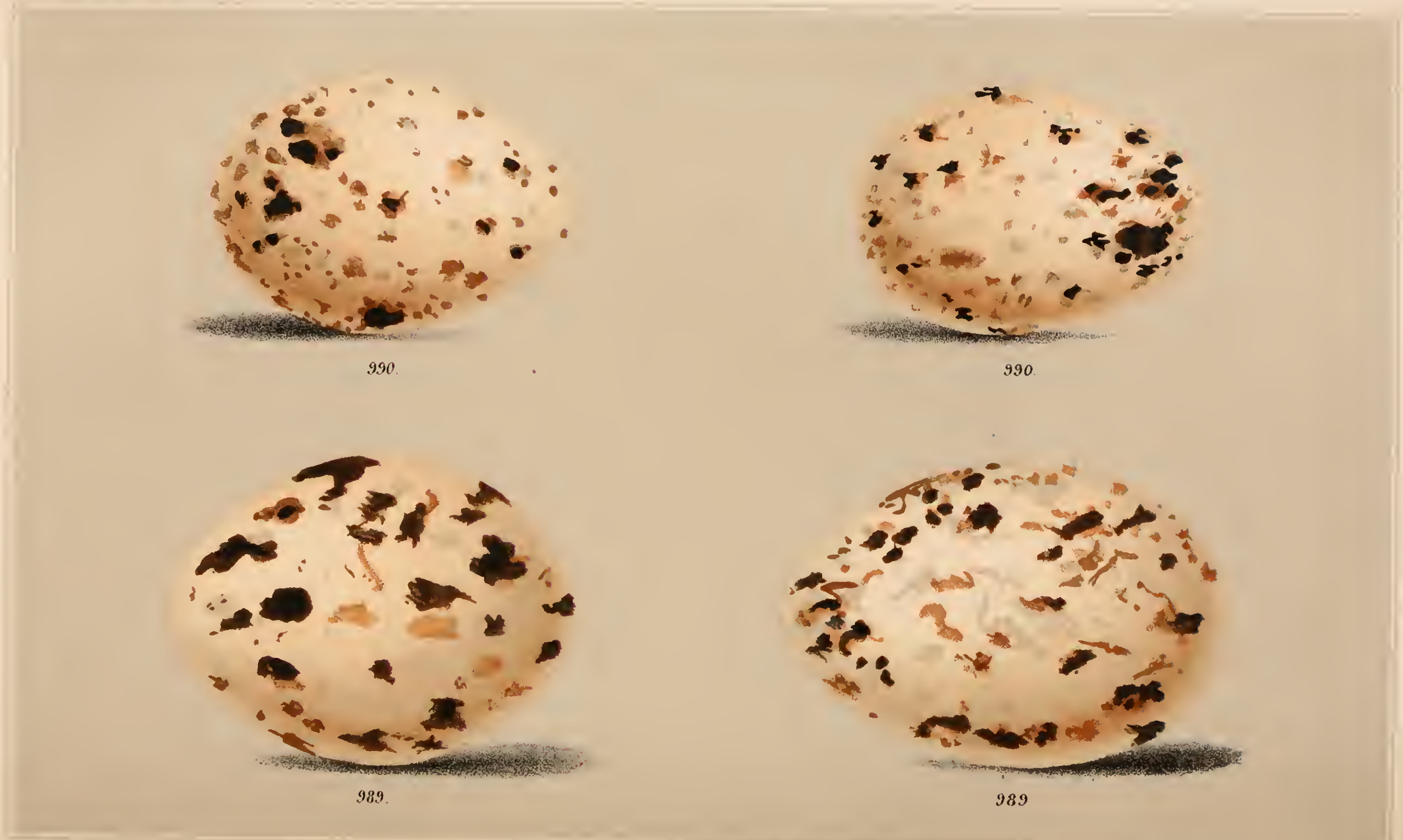
(Sd.) JOHN WALLACE,

Auditor.

(Sd.) E. M. SLATER.

Honorary Treasurer.

Bombay, 31st December, 1890.



H E B del.
Mintern Bros. Chromo lith. London.

990. STERNA MEDIA, Horsf. The Smaller Sea Tern. 989. STERNA BERGII, Licht, The Large Sea Tern.

JOURNAL

OF THE

BOMBAY

Natural History Society.

No. 3.] BOMBAY, 1891. [Vol. VI.

NESTING IN WESTERN INDIA.

By Lieut. H. E. Barnes, F.Z.S.

(*Continued from page 153, Vol. VI.*)

With a Plate.

944.—THE FLAMINGO.

Phœnicopterus antiquorum, Lath.

The Flamingo is very common in Sind; it is not uncommon near Bombay, and occurs as far South as Ratnagiri.

I do not think that any of them breed in India, but as Mr. Hume remarks, speaking of the Salt Lake at Sambhur, they have an untidy habit of dropping their eggs about before leaving the lake for their breeding haunts.

They breed in great numbers at the head of the Persian Gulf, and there is (or was) a splendid series of their eggs, obtained from thence, in the Frere Hall Museum, Karachi.

The eggs in my collection are moderately long ovals in shape somewhat pointed at both ends, and measure 3·64 inches in length by 2·28 in breadth.

The true egg is a very delicate bluish-white (skim-milk blue), but this is altogether obscured by a friable chalky covering which is easily removed.

944 *bis.*—THE LESSER FLAMINGO.

Phœnicopterus minor, G. St. Hill.

At times the Lesser Flamingo is very common at the Sambhur Lake, and has been occasionally observed in Sind. A specimen has also been recorded from Secunderabad in the Deccan.

Like the last, none remain to breed in India, but it has the same slipshod way of dropping its eggs about before leaving. Mr. Hume has received several from that locality.

A Sindhi fisherman, who used often to accompany me on nesting trips, brought me an egg which he had found on a sand bank on the Indus, some miles below Kotri. The egg was discolored and quite rotten, and burst when I attempted to clean it; it must have been lying on the sand for weeks. It was very similar to eggs of *Phœnicopterus antiquorum*, but from its small size I feel sure that it belonged to the present species, still it is quite possible that it was only an abnormally small egg of its larger congener.

I most carefully examined the huge series of Flamingo eggs in the Frere Hall Museum, Karachi, but failed to detect any so small, although they differed in size a good deal.

950.—THE NUKTAH.

THE BLACK-HEADED GOOSE.

THE COMB DUCK.

Sarcidiornis melanotus, Tem.

The Nuktah is not uncommon in parts of Guzerat, Rajputana, and the Deccan. It appears to be absent from Sind in the north, and from Ratnagiri in the south. In most other places it occurs as an occasional straggler.

Although strictly speaking it is not migratory, yet it wanders about a good deal, occurring in some parts only during the breeding season, but as a general rule they are permanent residents where found.

At the breeding season the fleshy knob on the bill of the drake becomes greatly enlarged, and it is to this that it owes its vernacular name (*Nuktah*), and also the name of "*Comb Duck*," by which it is known to most sportsmen.

They breed during the rains; the nest being generally placed in a large hole in a tree, occasionally in a hollow formed by two or three large branches where they spring from the trunk, and according to Jerdon, more rarely amongst the sedges and rushes on the borders of a jheel.

Personally I have never met with a nest in the latter situation.

The nest is composed mainly of sticks well lined with grass, leaves, and feathers, occasionally they are said to make use of old nests previously occupied by an eagle or large owl.

The eggs, from seven to twelve in number, are regular ovals in shape, slightly pointed at one end. The shell is smooth and compact in texture, and when fresh resembles polished ivory, but they soon become soiled. They measure about 2·3 inches in length by about 1·7 inches in breadth, but are subject to much variation in size, eggs of the same clutch even differing. Mr. Hume records finding a nest containing forty eggs, and was inclined to believe that they were the produce of a single bird.

I found two nests in the middle of the rains, both in holes in trees, one contained two eggs, the other was not quite finished. On visiting the place a fortnight later, I found to my disgust that a party of Brinjaries had only the day before snared the parent birds and had ate them and the eggs. They said that the nests contained eleven and nine eggs respectively.

Neemuch, August. *H. E. Barnes.*
Baroda, August (eggs). October (young). *H. Littledale, B.A.*

951.—THE COTTON TEAL.

Nettopus coromandelianus, Gmel.

The distribution of the Cotton Teal in Western India is very irregular. It is a common permanent resident in all the large tanks in the vicinity of Neemuch. Has been found breeding in a small tank near Baroda. Occurs in one or two of the rush-covered jheels between Ahmedabad and Deesa. It is not uncommon in some parts of the Deccan, and occurs in a few localities in Ratnagiri. In places where they are not much interfered with, they are very bold and confiding, allowing one to approach quite closely; but in the vicinity of garrison towns they are much more wary, keeping well out of range in the centre of the jheel or else hiding themselves amongst the rushes and lotus leaves on the borders.

They breed during the rains in holes in mango or other soft-wooded trees; occasionally in holes in old wells and buildings; more rarely still amongst patches of reeds or rushes.

The eggs are often laid without any attempt at making a nest, but usually there is more or less of a lining, consisting of fine grass and feathers, and occasionally a well-made nest is met with. When the nest is built amongst rushes, it is semi-floating, and is more carefully made.

The eggs, eight to twelve or fifteen in number, are very large for the size of the bird, averaging fully 1·7 inches in length by 1·3 in breadth, they are oval in shape and are of a delicate ivory white colour, but are not so glossy as those of the Nuktah, nor so liable to become discoloured.

Baroda, September to October. *H. Littledale, B.A.*

952.—THE LESSER WHISTLING TEAL.

Dendrocygna javanica, Hors.

The Lesser Whistling Teal or Wood-duck is a common permanent resident in Sind, and is far from uncommon in Central India and Rajputana, but in the Deccan it appears to be a somewhat rare winter visitor. They breed from about the middle up to the end of the rains. The nest is sometimes placed amongst the sedges, rushes, &c., along the borders of the jheels, which at this season are generally large sheets of water; just as often they occupy old Crow, Kite, or Heron's nests, and less frequently build a crow-like nest themselves amongst the branches of a tree, at from six to ten feet above the ground, generally in the vicinity of water.

The materials of which the nest is composed, consist of thin sticks and twigs, lined with grass and feathers. The eggs, eight to fourteen in number, are usually broad ovals, compressed a very little at one end; in colour they are pure white when fresh, but become sullied after they have been a few days in the nest.

They are very different in texture to eggs of the Cotton Teal and Nuktah; they vary a good deal in size, but the average of a large number was 1·86 in length by rather more than 1·5 in breadth.

Deesa (Milana), July and August.		*H. E. Barnes.*
Hyderabad (Sind),	*Do.*	*Do.*
Neemuch,	*Do.*	*Do.*

953.—THE LARGE WHISTLING TEAL.

Dendrocygna fulva, Gmel.

The large Whistling Teal occurs in Sind, and is stated to be very rare in the Deccan The only eggs I have seen were sent to me from Maldah. Although I have been twice stationed at Saugor, from whence the only eggs Mr. Hume ever received were obtained, yet I never once met with the bird, and I kept a good look out for it, more especially during the rains. At Hyderabad, Sind, I found a nest in a babool tree in the very centre of a deep and rather large jheel. I could see the bird sitting on the nest. I waded in as near as I could, but was too far away to hit the bird, although I fired to make her show herself, and then I felt certain that I had at last seen the long-sought-for Large Whistling Teal. The next day I turned up with a large plank, which I used as a raft, and sitting astride with one leg dangling on each side, I paddled off to the tree, but the bird was gone, so were the eggs, and the nest was pulled to pieces. My shikari told me afterwards that a sepoy of the Beluchi Regiment, hearing my shot, came to see what I had been firing at, and spotted the bird and nest, and so I lost them. I discovered afterwards that the tree could be easily approached from the opposite side. I have always had a private opinion that my shikari took a much more active part in the matter (even if he was not the principal actor) than he chose to admit.

The eggs in my collection are not larger than large eggs of the Lesser Whistling Teal, and I am doubtful about their authenticity. They measure 1·9 inches in length by 1·6 in breadth.

959.—THE SPOTTED-BILLED DUCK.

Anas pœcilorhyncha, Forst.

The Spotted-billed Duck is more or less common in suitable places throughout the Western Presidency, and appears to be a permanent resident wherever found, moving about of course as water is more or less plentiful.

They breed during the latter half of the monsoon, or as soon as the grass and rushes, amongst which the nest is placed, is sufficiently grown. Occasionally, but not often, the nest is placed on a flat branch of a tree, just above the surface of the water, but most often it is on the ground. The nest, which is well made, is composed of rushes and grass, and is lined with feathers from the mother's breast.

The eggs, six or seven in number, are broadish ovals in shape, and are of a greyish-white colour, getting dingy and sullied as incubation proceeds; they vary a good deal in size, but the average is about 2·15 inches in length by 1·7 in breadth.

I have often shot flappers in January, and have found them very good eating.

Mhow, August. *H. E. Barnes.*
Neemuch, August and September. *Do.*

960.—THE PINK-HEADED DUCK.

Rhodonessa caryophyllacea, Lath.

Colonel Swinhoe found the Pink-headed Duck to be not uncommon at the Depalpore Lake, near Mhow. I never had an opportunity of going there, neither did I ever see a specimen from thence, and I cannot help thinking that a mistake has been made, and it would be satisfactory if some sportsmen or other interested person would kindly verify the fact. At the same time, it must be remembered that the place is very strictly preserved, and very secluded, and is just the place suited to them, and although, so far as I know, this duck has not been reported from any other portion of the Presidency, it is not unlikely to occur there: if it does, it would of course breed. I therefore give a description of the nest and eggs. The nest is placed on the ground in long grass, is fairly well made, and is much the same as that of the Spot-billed Duck.

The eggs, six to seven in number, are quite unlike any other duck-egg known to me, being nearly spherical, measuring 1·78 inches in length by 1·66 in breadth.

The shell is compact but not particularly smooth in texture, and is of a dull whitish colour, generally a good deal sullied.

The only egg I have was given me by the Curator of the Indian Museum, Calcutta.

961*bis*.—THE MARBLED DUCK.

Chaulelasmus angustirostris, Ménétr.

I had some small duck eggs given to me years ago by the Curator of the Frere Hall Museum. At the time he said they belonged to the Blue-winged Teal. They came from the Mekran Coast, together with eggs of the Crab Plover. Colonel Butler, who received similar eggs about the same time, was of opinion that they were undoubted eggs of the Marbled Duck, consequently mine must be the same.

They are of a creamy-white colour, but are much soiled, and the lapse of years has not improved their appearance.

975.—THE LITTLE GREBE.

THE DABCHICK.

Podiceps minor, Lin.

The Little Grebe is found everywhere, wherever it can find water deep enough to swim in. It breeds towards the end of the rains, making a large floating or semi-floating nest, composed of aquatic weeds and rushes ; it is a mere pad or mass, with a depression in the centre for the eggs, which are usually five in number, and when fresh laid, pure white in colour, but they soon become sullied, and when incubated are often of a deep smoky brown. This is owing to the birds covering their eggs with wet weeds whenever they leave the nest. In fact, so inveterate is the habit, it seems impossible to prevent them from doing it. Many pairs breed annually on St. Mary's tank, Poona ; the Commissariat Store compound forms one side of the tank, and I have often crept noiselessly up in the early morning, just opposite to where I knew there was a nest, with the intention to surprise the sitting bird and make her leave the eggs uncovered, but the moment I would show myself, the bird would give a few vigorous pecks, and disappear almost instantaneously, and the eggs would be covered; only once did I succeed in getting the bird to leave the egg (for there was only one, and that was apparently just laid) uncovered. The nest was within five yards of the bank, and she dived as soon as she saw me, but even as I looked the egg disappeared I waded out to the nest, and found that the egg had been covered as usual; the bird had simply dived and returned with only its beak above water, and silently but effectually covered her egg; after this I discontinued my experiments.

The eggs are longish-ovals, usually pointed at both ends, but they are subject to much variation. They are slightly chalky, but fairly close in texture.

They average 1·4 inches in length by barely an inch in breadth.

981*ter*.—HEMPRICH'S GULL.

Larus hemprichi, Bonap.

Although the eggs of the Gulls and Terns are well represented in my collection, yet personally I know very little of their breeding habits. Mr. Cumming, the present Curator of the Frere Hall Museum, knows more about the breeding of the Indian Gulls and Terns than any man living, but he has placed little or nothing on record, and was too busy to respond to an appeal I made to him for information. I have had therefore to fall back on Colonel Butler, who did so much in his time for Indian Ornithology and Oology.

Hemprich's Gull is common in Karachi harbour and all along the Mekran Coast. It is one of the commonest Gulls about Aden, and breeds quite close, but I have not been able to get away to search for eggs, and I could not induce anyone else to do so.

The Arabs here are most indolent and will not do anything that they are unaccustomed to; for instance, I once shot a black-necked Grebe (*Podiceps nigricollis*) and, although there was a fisherman in his boat within fifty yards, he refused to pick it up for me, notwithstanding that I offered him a rupee to do so, and I had no alternative but to strip and fetch it myself, which was rather a risky thing to do, as the sun was high, and sharks by no means unknown, but the specimen was worth running some risk for.

Colonel Butler obtained the eggs from the island of Astolah, on the Mekran Coast, on the 6th August. The boatmen stated that the nests were similar to those of the crow, and were placed in the Salsola bushes on the top of the island; he heard afterwards from others that they sometimes laid upon rocks, but the nests are always well hidden, and are consequently hard to find. The maximum number of eggs appears to be three. They differ a good deal both in shape and size, but typically they are oval in shape, often a little pointed at one end. The ground-colour is a pale brown buffy-stone with numerous irregular blotches and spots of various shades of brown; in dark coloured varieties the markings approach to a coffee-brown.

The eggs vary from 2·1 to 2·45 inches in length and from 1·45 to 1·72 in breadth.

981*quat.*—THE SLENDER-BILLED GULL.

Larus gelastes, Licht.

The eggs I have of the Slender-billed Gull were given to me by Mr. Cumming, who took them personally somewhere near Fao in Persia, he told me at the time the exact place and date, but my notes have been mislaid, and I cannot quote them; Colonel Butler, through the agency of a friend, obtained them from a swamp, some eight miles from Ormarra, about the end of May.

The nests consisted of substantial pads of grass, raised a few inches above the ground, on mounds of sand, and were very solidly constructed. The eggs, usually three in number, are broadish ovals in shape, often pointed at one end. The ground-colour is dull white, rarely with a creamy tinge, and the markings, consisting of spots and blotches, are burnt umber, in some cases almost black and pale grey lilac. When the markings are small, they are generally distributed over the whole surface of the egg; if large, they are generally collected at the big end, forming a cap or zone.

They average 2·18 inches in length by about 1·52 in breadth.

982.—THE CASPIAN TERN.

Sterna caspia, Pall.

The Caspian Tern is not uncommon near Karachi, and occurs all along the Coast as far south as Ceylon. Colonel Butler received the eggs from the island of Warba, at the head of the Persian Gulf, early in April. The nests were abundant and built in colonies. They consisted of small mounds of sand, scraped up four or five inches high, and about a foot apart, with a few small sticks and twigs on the top. The eggs, usually three in number, are broadish ovals in shape, occasionally pointed at one end; the shell is compact but rather coarse in texture. In colour they are greyish-white tinged faintly with creamy or buffy-brown, sometimes but not often they are of a brownish stone-colour. The markings are small and thinly set, and consist of spots and specks of brown of various shades, with faint underlying spots of lilac or pale inky-purple. They vary in length from 2·3 to 2·75 inches and in breadth from 1·71 to 1·89. The eggs in my collection are intermediate in size between these two extremes.

983.—THE GULL-BILLED TERN.

Sterna anglica, Mont.

The Gull-billed Tern is not uncommon in the cold weather, but I do not think that any of them remain to breed within our limits.

Colonel Butler received eggs at the same time and from the same island, but from a different part of it, as the preceding.

The nests were similar to those of the Caspian Tern, and like them were placed on small mounds of sand about a foot or so apart. The eggs, three in number, are hard, fine and compact in texture, but quite free from gloss. They vary in colour from greyish-white to a decided brown, the markings consists of specks and spots of various shades of sepia-brown, with underlying clouds and blotches of inky-purple or greyish-brown.

They vary from 1·83 to 2·2 in length and from 1·35 to 1·57 in breadth. My eggs measure 1·9 by 1·48.

985.—THE INDIAN RIVER TERN.

Sterna seena, Sykes.

During the cold weather the Indian River Tern occurs more or less commonly throughout the greater part of Western India, the exception being the Konkan, where its occurrence appears doubtful.

Some few remain to breed in Rajputana and Guzerat, as I have taken eggs in both these districts in April.

In Sind it is very common and is a permanent resident, breeding in great numbers during April and May, on the sandy islands, in the bed of the River Indus. On one of these islands alone, a small one, about a mile below Kotri, I counted over one hundred nest-holes, and most of them contained three eggs each, some few had four.

Although there were so many nests, they were a good deal scattered, and required looking for, as they are difficult, especially to an unpractised eye, to see, as they assimilate so perfectly with the sand on which they are placed.

The eggs are laid in a small depression scratched in the sand; in shape they are rather broad ovals, fine and smooth in texture, measuring about 1·64 inches in length by 1·24 in breadth; the ground-colour varies from pale greenish-grey to a warm buffy-stone, and they are streaked, spotted and lined with various shades of dark brown, with the usual underlying clouds and blotches of faint inky-purple or lilac.

Mr. Hume, in his *Nests and Eggs of Indian Birds, 1st edition,* says that these two types are commonly found in the same nest, and infers that they are the produce of one bird, I feel sure that this is a mistake. I have had opportunities of inspecting hundreds of nests, and although now and then I have found a greenish-grey egg with three buffy ones, or a buffy egg with three greenish-grey, yet ordinarily they are all of the same type and depth of colouring; and it seems to me quite obvious that the odd egg has been dropped into the nest-hole by another bird.

Neemuch,	*April.*	*H. E. Barnes.*
Deesa,	*Do.*	*Do.*
Hyderabad (Sind),	*March and April.*	*Do.*

987.—THE BLACK-BELLIED TERN.

Sterna melanogastra, Tem.

The Black-bellied Tern seems to be a more or less common permanent resident throughout the Western Presidency, but I do not think that it occurs in the Konkan. Colonel Butler did not meet with it in Northern Guzerat, but I cannot help thinking that he has overlooked it. They breed during March, generally ten or fourteen days before its larger congener, the Indian River Tern.

Although a good many pairs breed together, yet the nests are as a rule a good deal scattered, and like those of the preceding are hard to discover. The eggs are placed in small depressions scratched in the sand; the number seems to vary. I found a clutch of four near Neemuch and had another clutch of four brought in, but on the sandy islets of the Indus I never found more than two eggs or two nestlings.

The eggs are moderately broad ovals in shape, pointed at one end; they measure about 1·25 inches in length by 0·96 in breadth. They vary in colour a good deal, but are typically buffy, and the markings, consisting of spots and specks, and occasionally blotches, are of a purplish or reddish-brown, with faint underlying clouds of inky-purple.

They are often found breeding in close proximity to the Indian River Tern.

Neemuch,	*March.*	*H. E. Barnes.*
Hyderabad, Sind,	*Do.*	*Do.*

987 *bis.*—THE WHITE-CHEEKED TERN.

Sterna albigena, Licht.

During the cold weather the White-cheeked Tern is very common all along the Coast, from Ratnagiri in the south to Karachi harbour in the north, continuing to be common on the Mekran Coast. They breed on the islands at the head of the Persian Gulf.

Colonel Butler received eggs of this species from the island of Allah on the 10th June, and as I am indebted to Mr. Hume's kindness for one of these very eggs, I cannot do better than quote his note in full.

[Colonel Butler received eggs of this species from the Persian Gulf. The gentleman who took them thus writes:—"As requested, I made another trip on the 10th of June to the island of Allah, about 40 miles east of Bushire, where the eggs you got were taken from. At low tide it is one island, but at high tide becomes two, from low ground in the centre becoming submerged. *Sterna albigena* was breeding on one, and *Sterna anæstheta* on the other. The former (*Sterna albigena*) lays in the open on the bare ground; no nest, but in some instances, a few pieces of twigs were observable. Eggs, in number one or two, not more. One egg was peculiar, being almost white without any spots, the bird was shot off the nest, so there could be no mistake. The eggs of this species, like those of most of the Terns, vary a good deal in shape, size and colour. Typically they are moderately broad ovals somewhat pointed towards the small end, but some specimens are quite of the hen-shaped type, others are broader and slightly pyriform, while I have three or four very elongated ovals markedly pointed towards the small end. Typically the ground-colour is a moderately pale brownish-yellow-stone colour, but occasionally this brightens to a warm *cafe-au-lait;* in many it is only creamy, and rarely it is almost pure white. Typically, again, the markings are neither very large or very dense. Moderate-sized blotches, specks and spots of a brown, varying from deep umber brown, almost black, through a variety of shades to almost sepia brown. In some eggs all these primary markings are very small. One egg in twenty exhibits a few good sized blotches. Beside these primary markings, all the eggs exhibit more or less numerous grey or pale inky-purple sub-surface looking streaks, clouds and spots.

In one or two eggs the primary markings are altogether wanting, and they exhibit none but these secondary ones. One egg we got had the ground white and was absolutely devoid of all markings. Variations like this occur in most species; even in highly coloured eggs, like *Œdicnemus scolopax,* similar white varieties occur. The texure of the shell is fine and compact, but it is entirely devoid of gloss.

The eggs vary from 1·48 to 1·71 in length and from 1·07 to 1·21 in breadth."

Nests and Eggs of Indian Birds, 2nd edition, Vol. III, page 311.

988*ter*.—SAUNDER'S TERN.

Sterna saundersi, Hume.

The Little Tern occurs during the cold weather as far south as Ratnagiri; at Karachi it is very common, and is a permanent resident, breeding abundantly during May and June on the plain between the Camp and Clifton, where I, in company with Mr. Murray, have taken many eggs. A friend, to whom I wrote two years ago, informed me that the birds had all but deserted the place, and that it was only by the most careful search and after going several times that he managed to secure two clutches for me. The eggs, two in number, never more, are placed in slight natural depressions in the ground, in hoof prints, cart ruts, or else on tiny hillocks, but always where the ground is comparatively hard and dry, and slightly elevated above the surrounding damp soil; they do not seem to scratch holes for themselves.

In shape they are moderately broad ovals, a good deal pointed towards one end. They are fine in texture, but very fragile.

The ground-colour is a clayey-brown, and they seem to keep fairly true to the type, not exhibiting such extreme variations as most Tern-eggs do. The marking are specks and spots, thinly scattered over the whole surface of the shell, with here and there a niggly scratch or line, with an occasional blotch or smudge of the same shade of colour; the secondary markings are larger, and, if anything, more numerous, and are of a faint soft lilac-grey or pale inky-purple.

They average about 1·2 inches in length by nearly 0·9 in breadth.

Karachi, *May and June.* *H. E. Barnes.*

989.—THE LARGE SEA TERN.

Sterna bergii, Licht.

The Large Sea or Crested Tern is common all along our coasts, and breeds abundantly on the island of Astolah, on the Mekran Coast, on the islands at the head of the Persian Gulf, and I myself have procured large series of eggs from islands off the Somali Coast.

Colonel Butler found them breeding during May, but mine were obtained in August.

They breed in immense colonies, the birds almost touching each other as they sit, this they do to protect their eggs from the Gulls and other birds, who destroy them whenever they get an opportunity.

The full number of eggs in a clutch is three, but occasionally two fully incubated eggs will be found; there is no nest, the eggs being placed in depressions scratched in the sand; they are broad ovals in shape, very much pointed towards one end, but variations from the type are not uncommon; they have no gloss, but the texture of the shell is firm and compact. The ground-colour varies a good deal; white, greenish-, and pinkish-white, pale yellowish, pale buff, pinkish stone-colour and warm salmon-pink, all occur.

The markings are also very variable, consisting of specks, spots, streaks, blotches and jagged lines of a deep burnt sienna-brown, in some eggs almost black; the secondary markings are the usual pale, washed-out underlying clouds and blotches of lilac and faint inky-purple.

They are usually very handsome eggs. They vary a good deal in size, but not more so than those of most large Terns do. The average of a large number was 2·45 inches in length by about 1·7 in breadth.

Doctor Bartlett, of the Indian Medical Department, sent a fisherman from Aden to look for eggs in August, the man returned having been to Obok, a French settlement on the Somali Coast, with a great number of eggs of the Large Sea Tern (*Sterna bergii*) and the Smaller Sea Tern (*Sterna media*). There were some others, a few of the Sooty Tern (*Sterna fuliginosa*), and one pair of the White-cheeked Tern (*Sterna albigena*), and several that I felt doubtful about, as I had no eggs for comparison, having left my collection behind at Saugor, C. P., and it does not do to trust one's memory. He kindly gave me as many of these eggs as I wanted.

990.—THE SMALLER SEA TERN.

Sterna media, Hors.

The Smaller Sea Tern is very common about Karachi harbour, and occurs for some distance along the coast.

They breed abundantly on the islands at the head of the Persian Gulf. Colonel Butler obtained a large series from the island of Arabê in the Persian Gulf. He does not state the date on which he got them.

I received eggs from an island of the Somali Coast, and others from an island near the French settlement of Obok in August.

The full complement of eggs is three, and they are laid on the bare ground, after the manner of those of its larger relative ; they are oval in shape, occasionally moderately broad, and are pointed at one end, the texture is fine but glossless. The ground-colour is white, rarely buffy-white, the primary markings, which are as a rule thinly scattered over the whole surface of the shell, are very dark in colour, almost black, there are generally one or two large blotches of this colour, blackish in the centre, but becoming reddish-brown at the edges ; the smaller spots, too, are often surrounded by a kind of reddish nimbus, which adds much to the beauty of the egg ; the secondary markings are pale lilac or faint inky-purple, and have the appearance of lying beneath the surface of the shell, but they are few in number and often not very apparent.

They vary greatly in size, from 2·36 to 1·9 inches in length, and from 1·5 to 1·37 inches in breadth, but the average of a very large series, carefully measured, was 2·15 by 1·44.

990*bis*.—THE SANDWICH TERN.

Sterna cantiaca, Gm.

This Tern is not uncommon on the Sind and Mekran Coasts, where it is stated to breed, but I have never seen an egg, neither can I find any description of one, and I only notice it here, in the hope that some one more fortunate may be able to supply the information required.

992.—THE BROWN-WINGED TERN.

Sterna anæstheta, Scop.

The Brown-winged or Panayan Tern is common along the sea-coast. Mr. Hume found thousands of rotten and addled eggs on the Vingorla Rocks when he visited them in February. They had apparently been lying there since the monsoons. Many dead birds, both young and old, enabled him to identify the species to which they belonged.

Colonel Butler has left on record two or three notes on the breeding of these birds near Bushire, which I reproduce:—

"A few eggs of the Panayan Tern (at least said to belong to this species) were taken for me by some fishermen about the 8th June,

1878. They were found on mud banks on the island of Tungistan, about 40 miles east of Bushire, in the Persian Gulf, and the nests, which contained from two to four eggs (considerably incubated) each, were simply round depressions in the ground, scratched by the birds themselves. The eggs vary much in ground-colour and markings, some of them reminding one of the eggs of *Sterna saundersi*. I have no doubt about these eggs, as a skin of *Sterna anæstheta* was forwarded with them, and a note saying that there were no other Terns laying in the island at the time they were taken."

He adds a couple of notes:—"A quantity of eggs taken on an island 16 miles south of Bushire on the 18th July, 1878. The nest consisted of a slight depression in the sand, just above high-water mark. Seldom more than one egg in a nest, sometimes two, but never more."

"Lays but one single egg, very similar to the egg of *Sterna albigena,* but rather larger. They burrow about one to one-and-a-half feet under shrubs or tufts of grass. Sometimes they lay on the ground under shrubs without burrowing, but never in an exposed situation. The eggs are always carefully concealed, and consequently difficult to find. The eggs I found were all in a patch of grass and shrubs about 80 yards long, growing thickly together. No nest."

Mr. Hume thus describes the eggs :—

"In shape the eggs seem to be normally very much that of a hen's egg, though somewhat more pointed and elongated examples occur. The ground-colour appears to vary from nearly pure white to a rich pinky-stone colour. The primary markings, often small, never apparently very large, and never very thickly set, are a rich reddish or burnt-sienna-brown, becoming black in some spots; besides these, chiefly towards the larger end of the egg, a certain number of pale purplish-grey specks and spots are observable, occasionally they are pretty densely set about the large end, but in many eggs they are very sparse and small. The shell, as usual in these Terns, is very fine and close, but entirely devoid of gloss.

The eggs vary from 1·61 to 1·88 inches in length, from 1·16 to 1·29 inches in breadth." *Nests and Eggs of Indian Birds, 2nd Edn., Vol. III., p. 300.*

992*bis*.—THE SOOTY TERN.

Sterna fuliginosa, Gml.

I am indebted to Mr. Cumming for an egg of the Sooty Tern. It was taken on an island at the head of the Persian Gulf, but I am not in a position to give the particulars. I have also seen a couple of eggs that were taken from an island on the Somali Coast.

Having but a single egg, I cannot do better than quote Mr. Hume's description:—

"The eggs of this species are very variable, both in size, colour, and markings. Typically, they are moderately elongated, rather regular ovals, somewhat pointed, as a rule, towards the smaller end, but some are of the ordinary hen-egg shape, and a few are markedly elongate.

The shell is very fine and compact, but has no gloss. The ground-colour varies from white to pinky-white, and from this latter to a yellowish-pinkish stone-colour. The primary markings consist of large blotches, spots, streaks and specks of a very rich brown, which on the pinkish eggs is often decidedly red, and on the rest is a sienna-brown (burnt or raw). The secondary markings, which look more or less as if they were beneath the shell, consist of spots and blotches of pale purple-lilac, purplish-brown or grey, the shade varying in different specimens.

The extent and character of the markings vary much. In some eggs all the markings are small and spotty, in others the majority are large and bold; in some they are scattered evenly over the whole egg, in the majority they are most numerous about the large end; in some the markings are pretty densely set, in others they are very sparse.

In length the 23 eggs I was able to preserve varied from 1·86 to 2·03, and the breadth from 1·26 to 1·45, but the average of the lot is 1·96 nearly by 1·34." *Nests and Eggs of Indian Birds, 2nd Edn., Vol. III., p. 303.*

995.—THE SCISSOR BILL.

THE INDIAN SKIMMER.

Rhynchops albicollis, Swains.

The Scissor Bill is very common on the Indus, and I once saw one, just before the monsoons, skimming over the lake at Jeerun, about

12 miles from Neemuch, Central India ; it has also been seen once on the Nukhi Talao at Mount Aboo : and on one of the big lakes near Khanpur, in the Oodeypore district. It is however a bird of the larger rivers, and these instances are very exceptional.

They breed on the sandy islets in the bed of the river Indus, along with the Indian River Tern (*Sterna seena*), the Black-bellied Tern (*Sterna melanogastra)*, the Small Swallow Plover (*Glareola lactea*), and the Large Sand Plover (*Æsacus recurvirostris*).

They scrape a small hollow in the sand, make no nest, the eggs, usually four in number, being placed on the bare sand ; they are moderately broad ovals in shape, usually pointed at one end, averaging 1·6 inches in length by rather more than 1·18 in breadth, but they vary a good deal in size.

The ground-colour is very various, faint greenish-white, greyish-white, salmon-colour, pale pinkish-buff, and creamy-stone all occur. The markings are bold, consisting almost always of large blotches, or streaks, chocolate, reddish-brown, and rich umber, and underlying clouds and streaks of pale inky-purple and lilac ; the markings give the eggs a most peculiar appearance, as they are not parallel but are twisted round the egg in a slanting direction. I have a clutch of Snipe eggs (*Gallinago gallinaria*), which I procured in England, when on furlough, almost identical in the character of the markings.

Hyderabad, Sind, April. *H. E. Barnes.*

1001.—THE WHITE PELICAN.

Pelecanus onocrotalus, Lin.

I believe this Pelican (which I have shot near Hyderabad, Sind), to be quite distinct from either the Lesser White Pelican (*Pelecanus javanicus*), or the Grey Pelican (*Pelecanus philippinus*). It is a much heavier and larger bird then *Pelecanus javanicus*, and never, so far as I know (and I have seen a goodly number here in Aden), assumes that lovely delicate rosy hue, that transfers the Lesser White Pelican from comparative plainness to positive beauty. Young birds have a good deal of grey about them, but not so much as the birds I used to shoot near Deesa during the rains, and which besides was a smaller bird. Colonel Butler identified this bird as *Pelecanus philippinus*, and I believe his views were fully endorsed by Mr. Hume.

At all events, whatever its name, *orocrotalus* or *crispus*, this large white bird breeds near Fao in Persia, as owing to the kindness of Mr. Cumming, I have an egg taken personally by him in that locality.

This egg is pure white and is much larger than any I have seen of *Pelecanus philippinus*, * measuring 3·5 inches in length and 2·3 inches in breadth.

I have included this bird, the Gulls, Terns, and Flamingos, although they have not all of them, strictly speaking, been found breeding within our limits, yet their eggs are to be found in most Western Indian Collections of any note, and as they most probably breed in many of the islands off our coast, during the monsoons, when they are most of them practically inaccessible. We know this to be the case on the Vingorla Rocks, and broken eggs-shells have been found on several of the others.

1005.—THE LARGE CORMORANT.

Phalacrocorax carbo, Lin.

The Large Cormorant is very rare, even if it occurs at all, in the Konkan, and it has not, so far as I know, ever been recorded from Ratnagiri, but in most other parts of Western India it is a more or less common visitant. In Sind it is a permanent resident, breeding during the months of July, August and September.

Mr. Doig, to whom I am indebted for eggs of this bird, as well as for many others, found them breeding in a vast colony in a large swamp in the Eastern Narra District. The breeding ground was about a mile long and eighty yards wide.

The nests were platforms, composed of sticks and twigs more or less scantily lined with rushes and grass. They were placed on tamarisk trees growing in water, and were from four to six feet above the water, so that he could easily reach them by standing up in the boat. They use the same nest during successive seasons, adding a few sticks to the old nest. Mr. Doig remarks that owing to this habit, many of them were as much as three feet thick.

The eggs, usually six, occasionally only four or five, and very rarely seven in number, are long ovals in shape, pointed at the small end ;

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* *Pelecanus manillensis*, Oates.

they measure 2·4 inches in length by 1·55. They are covered with a friable chalky deposit, which is easily removed, and frequently falls off partially in the nest, giving the egg a mottled appearance ; the colour of the shell beneath being of a pale bluish-green, approximating to those of the Heron family.

I do not think that any of them breed on rocks within our limits, but in other parts of India they do so.

Mr. P. W. Mackinnon, of Masuri, informs me that he has often seen them breeding on the cliffs overhanging the river Ganges, a good way up near the snow.

Eastern Narra, Sind, November. *S. Doig.*

1006.—THE LESSER CORMORANT.

Phalacrocorax fuscicollis, Step.

There still seems to be a great deal of doubt as to whether the Lesser Cormorant occurs permanently in Western India anywhere outside of Sind. I have shot birds at Neemuch, Deesa and Aboo, at a time when they ought to be breeding, which, I at the time, identified as *Phalacrocorax fuscicollis*, but I may have been mistaken.

There is no doubt about its being a permanent resident in Sind, as Mr. Doig found them breeding abundantly in the Eastern Narra, in company with the Snake Bird (*Plotus melanogaster*), and the Small Cormorant (*Phalacrocorax pygmæus*).

The nests are similar to those of the Large Cormorant, but are rather smaller ; the eggs 4 or 5 in number are exact counterparts, in regard to shape and colour, of those of its larger relative ; they are much larger than one would expect from the size of the bird, and are barely distinguishable from those of the Indian Snake Bird which is a larger and heavier bird.

They measure from 1·98 to 2·25 inches in length, and from 1·28 to 1·6 in breadth.

Eastern Narra, Sind, July to December. *S. Doig.*

1007.—THE LITTLE CORMORANT.

Phalacrocorax pygmæus, Pall.

The Little Cormorant is, I believe, a permanent resident in most parts of the Presidency ; Mr. Vidal was of opinion that they leave the

Ratnagiri District during the breeding season, but I fancy they do not go very far away. All the birds of this family, as well as the Snake-birds and Herons, have a habit of breeding in immense colonies, and the birds from many miles around congregate together at some favoured spot, as the breeding season approaches, and one may at that season travel many miles without seeing one of them, and would therefore be under the impression that they had left the country.

They seem as a rule to prefer Babool, or other thorny trees growing in the middle of some swamp or pond. Both nests and eggs are miniatures of the two preceding.

The eggs, four or five in number, measure about 1·75 inches in length by 1·16 in breadth.

Eastern Narra, Sind,	*June to December.*	*S. Doig.*
Milana near Deesa,	*November.*	*H. E. Barnes.*

1008.—THE INDIAN SNAKE BIRD.

THE DARTER.

Plotus melanogaster, Penn.

The Indian Snake Bird occurs generally throughout Western India, breeding during the monsoons. Mr. Doig found them breeding in a huge colony in the Eastern Narra, Sind. I found them breeding in some numbers on one of the lakes at Milana, about 18 miles from Deesa, and got a good lot of eggs, which, however, were much incubated. The villagers assured me that they bred annually on these very trees, but I did not see any very large nests, like those Mr. Doig observed, belonging to the Large Cormorant. I took a fully formed egg from the ovaries of a bird I shot at Deesa, but I could find no nests, neither would the people near give me any information

They place their nests on trees, Babool preferred, generally growing well out in the water. The eggs, three or four in number, closely resemble those of the Cormorants.

They average 2·12 inches in length by 1·37 in breadth.

Eastern Narra, Sind,	*June to December.*	*S. Doig, Esq.*
Milana, near Deesa,	*September.*	*H. E. Barnes.*

These notes are now finished, and I must ask my brother oologists in the Western Presidency to overlook their many shortcomings; the omissions and mistakes are possibly many, but this is to be looked for in the present imperfect state of our information.

Should the publication of them result in calling the attention of naturalists and sportsmen to the meagre extent of the knowledge we possess of the breeding of birds in Western India, more especially in the outlying portions, such as Ratnagiri and Kanara in the south, the Runn of Cutch in the west, and Upper Sind in the north, and lead them to place on record in the pages of the Journal of the Bombay Natural History Society all they already know, and any new facts that they may learn hereafter, the object for which they were written will be accomplished.

Many of the names used have long been obsolete, but at the time I commenced the compilation, now nearly four years ago, the latest complete information within my reach was Mr. Hume's catalogue, published in *Stray Feathers,* and as most Indian collections were then arranged on this basis, I thought it best to adhere closely to it, although in many instances I was of course aware that the names were out of date, and it would have been easy to have made partial corrections. The publication of Hume's "Nests and Eggs," 2nd Edition, edited by Mr. Oates, has now made this an easy matter to rectify, and I have added a list that will make the notes intelligible to those in possession of that invaluable book.

In the earlier parts I had the able assistance of Mr. Davidson, C.S., who kindly examined the manuscript before publication, and it is to his extensive knowledge of birds and their ways that many of the notes are due. Unfortunately for me, he went home on furlough, and I lost his help and advice.

To Mr. H. Littledale, B.A., of Baroda, my thanks are also due. He generously made over to me all his notes on the breeding of birds in his vicinity. I have most unhesitatingly made use of all information accessible to me, more especially from the pages of *Stray Feathers,* where most of the experiences of Captain (now Colonel) Butler and Mr. S. Doig are recorded.

I regret that I have been unable to make much use of the 2nd Edition of "Nests and Eggs of Indian Birds," as almost all of these notes were completed, and indeed printed before its publication.

I must also thank our energetic Honorary Secretary, Mr. H. M. Phipson, for the support he has given me; had it not been for his kind persuasion and encouragement, they would never have appeared.

H. E. BARNES.

⁂ *(The above concludes the Series of Papers on "Nesting in Western India," by Lieutenant H. E. Barnes, F.Z.S., which were commenced in Vol. III., Part IV. of 1888, and the author is now anxious that members of this Society should send him Notes on the subject, containing either additions or corrections, to be published in a few months as a Supplement. It is to be hoped that readers of this Journal will respond to Lieutenant Barnes' appeal, so as to enable him to place on record, as far as possible, the present state of our knowledge as to the breeding of birds on this side of India.—Editor.)*

LIST giving REFERENCES to *Hume's Nests and Eggs of Indian Birds, 2nd edition, edited by Mr. E. W. Oates, and correct scientific name.*

No. and Name in Hume's Catalogue.		Reference.		REMARKS.
	ORDER RAPTORES. FAMILY VULTURIDÆ.	Vol.	Page.	
2	Otogyps calvus, *Scop*	III.	206	
3*bis.*	Gyps fulvescens, *Hume*	III.	209	
4*bis.*	,, pallescens, *Hume*	III.	203	
5	Pseudogyps bengalensis, *Gm.*	III.	205	
6	Neophron ginginianus, *Lath.*	III.	213	
	FAMILY FALCONIDÆ.			
9	Falco peregrinator, *Sund.*	III.	184	
11	,, jugger, *J. E. Gray*	III.	186	
16	,, chicquera, *Dand*	III.	192	
17	Cerchneis tinnunculus, *Lin*	III.	195	Tinnunculus alaudarius, *Lin.*
23	Astur badius, *Gm*	III.	119	
28	Aquila clanga, *Pall*	III.	138	
29	,, vindhiana, *Frankl.*	III.	132	
30	,, hastata, *Less.*	III.	136	
33	Nisaëtus fasciatus, *Vieill*	III.	139	
35	Limnaëtus cirrhatus, *Gm.*	III.	147	Spìzaëtus cirrhatus, *Gm.*
38	Circaëtus gallicus, *Gm*	III.	150	
39	Spilornis cheela, *Lath.*	III.	153	
39*bis.*	,, melanotis, *Jerd.*	III.	156	
42	Haliatus leucoryphus, *Pall.*	III.	163	
43	,, leucogaster, *Gm.*	III.	161	
48	Butastur teesa, *Frankl.*	III.	158	
55	Haliastur indus, *Bodd.*	III.	170	
56	Milvus govinda, *Sykes.*	III.	173	
57	Pernis ptilorhynchus, *Tem.*	III.	181	
59	Elanus cœruleus, *Desf.*	III.	177	

No. and Name in Hume's Catalogue.		Reference.	Remarks.
	FAMILY STRIGIDÆ.		
60	Strix javanica, *Gm.*	III. 93	
65	Syrnium ocellatum, *Less.*	III 115	
69	Bubo bengalensis, *Frankl.*	III. 99	
70	,, coromandus, *Lath*	III. 101	
72	Ketupa ceylonensis, *Gm*	III. 96	
75*ter.*	Scops bakkamuna, *Forst.*	III. 105	
75*quat*	,, malabaricus, *Jerd*	III. 107	
76	Carine brama, *Tem.*	III. 108	
76*qnt.*	Heteroglaux blewitti, *Hume*	....	
77	Glaucidium radiatum, *Bly*	III 112	
78	,, malabaricum, *Tick* .	III. 113	
	ORDER INSESSORES FAMILY HIRUNDINIDÆ.		
84	Hirundo filifera, *Steph.*	II. 188	Hirundo smithii, *Leach.*
85	,, erythropygia, *Sykes*	II. 197	
86	,, fluvicola, *Jerd*	II. 191	
89	Cotyle sinensis, *J. E. Gray.*	II. 178	
90	,, concolor, *Sykes*	II. 180	Ptyonoprogne concolor, *Sykes.*
98	Cypselus melba, *Lin.*	III. 20	
100	,, affinis, *J. E. Gray.*	III. 21	
102	,, batassiensis, *J. E. Gray.*	III. 25	
103	Collocolia unicolor, *Jerd*	III. 28	
104	Dendrochelidon coronata, *Tick.*	III. 36	Macropteryx coronatus, *Tick.*
	FAMILY CAPRIMULGIDÆ.		
107	Caprimulgus indicus, *Lath*	III. 40	
108	,, kelaarti, *Bly*	III. 41	
111	,, atripennis, *Jerd.*	III. 47	
112	,, asiaticus, *Lath*	III. 48	
113	,, mahrattensis, *Sykes*	III. 49	
114	,, monticolus, *Frankl.*	III. 51	
	FAMILY MEROPIDÆ.		
117	Merops viridis, *Lin.*	III. 60	
118	,, philippinus, *Lin.*	III. 63	
	FAMILY CORACIADÆ.		
123	Coracias indica, *Lin.*	III. 53	
	FAMILY HALCYONIDÆ.		
127	Pelargopsis gurial, *Pears.*	III. 11	
129	Halcyon smyrnensis, *Lin*	III. 15	
134	Alcedo bengalensis, *Gm.*	III. 1	
134*bis.*	,, ispida, *Lin.*	....	
136	Ceryle rudis, *Lin.*	III. 8	

MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS.

No. and Name in Hume's Catalogue.		Reference.	Remarks.
	FAMILY BUCEROTIDÆ.		
140	Dichoceros cavatus, *Shaw*	III. 68	Dichoceros bicornis, *Lin.*
141	Hydrocissa coronata, *Bodd.*	....	
144	Ocyceros birostris, *Scop.*	III. 74	
145	Tockus griseus, *Lath.*	....	
	FAMILY PSITTACIDÆ.		
147	Palæornis eupatria, *Lin.*	III. 82	
148	,, torquatus, *Lin.*	III. 85	
149	,, purpureus, *P.L S. Mull*	III. 87	
151	,, columboides, *Vig.*	III. 89	
	FAMILY PICIDÆ.		
158	Picus sindianus, *Gould*	II. 303	Dendrocopus sindianus, *Gould.*
160	,, mahrattensis, *Lath.*	II. 305	Liopicus mahrattensis, *Lath.*
164	Yungipicus nanus, *Vig.*	II. 306	Iyngipicus hardwickii, *Jerd.*
166*bis.*	Chrysocolaptes delesserti, *Malh.*	II. 313	Chrysocolaptes gutta-cristatus, *Tick.*
167	,, festivus, *Bodd.*	II. 312	
175	,, chlorigaster, *Jerd.*	....	
179	Micropterus gularis, *Jerd*	....	
180	Brachypternus aurantius, *Lin*	II. 309	
181	,, puncticollis, *Malh.*	....	
182	,, dilutus, *Bly*	....	
	FAMILY MEGALAIMIDÆ.		
193*bis.*	Megalaima inornata, *Wald*	II. 322	Megalaima caniceps, *Frankl.*
194	,, viridis, *Bodd.*	II. 325	Cyanops viridis, *Bodd.*
197	Xantholœma hæmacephala, *P. L. S. Mull.*	II. 329	
	FAMILY CUCULIDÆ.		
199	Cuculus canorus, *Lin*	II. 379	
203	,, micropterus, *Gould*	....	
212	Coccystes jacobinus, *Bodd*	II. 388	
214	Eudynamis honorata, *Lin*	II. 392	
216	Rhopodytis viridirostris, *Jerd*	II. 399	
217	Centrococcyx rufipennis, *Ill*	II. 400	
217*qnt.*	,, maximus, *Hume*	II. 405	
219	Taccocua leschenaulti, *Less.*	II. 408	
220	,, sirkee, *J. E. Gr.*	II. 408	
222	,, affinis, *Bly*	....	
	FAMILY NECTARINIDÆ.		
226	Æthopyga vigorsi, *Sykes*	II. 250	
232	Cinnyris zeylonica, *Lin*	II. 263	Arachnechthra zeylonica, *Lin.*
233	,, minima, *Sykes*	II. 262	
234	,, asiatica, *Lin*	II. 252	

No. and Name in Hume's Catalogue.		Reference.	REMARKS.
	FAMILY NECTARINIDÆ. continued.		
235	Cinnyris lotenia, *Jerd*	II. 251	
238	Dicœum erythrorhyncha, *Lath* ...	II. 274	
239	,, concolor, *Jerd*	II. 272	
240	Piprisoma agile, *Tick*	II. 277	Piprisoma squalidum, *Bur.*
253	Dendrophila frontalis, *Horsf*.......	I. 196	Sitta frontalis, *Horsf.*
	FAMILY UPUPIDÆ.		
255	Upupa ceylonensis, *Reich*	II. 334	
	FAMILY LANIADÆ.		
256	Lanius lahtora, *Sykes*	I. 306	
257	,, erythronotus, *Vig*........	I. 318	
260	,, vittatus, *Val.*	I. 311	
265	Tephrodornis pondicerianus, *Gm.*	I. 332	
267	Hemipus picatus, *Sykes*	I. 327	
268	Volvocivora sykesi, *Strick*........	I. 346	Campophaga sykesi, *Str.*
270	Graucalus macii, *Less*	I. 348	
272	Pericrocotus flammeus *Forst*......	I. 336	
276	,, peregrinus, *Lin.*	I. 339	
277	,, erythropygius, *Jerd*	I. 344	
278	Buchanga atra, *Herm*	I. 198	Dicrurus ater, *Her.*
280	,, longicauda, *Hay.*	I. 203	,, longicaudatus, *Hay.*
281	,, cœrulescens, *Lin*........	I. 209	,, cœrulescens, *Lin.*
282	Chaptia aënea, *Vieill.*...............	I. 210	
285	Dissemurus paradiseus, *Scop*	I. 217	
287	Artamus fuscus, *Vieill*	I. 350	
	FAMILY MUSCICAPIDÆ.		
288	Muscipeta paradisi, *Lin*...........	II. 22	Terpsiphone paradisi, *Lin.*
290	Hypothymus azurea, *Bodd.*	II. 27	
292	Leucocerca aureola, *Vieill*..........	II. 31	Rhipidura albofrontata, *Fran.*
293	,, leucogaster, *Crn.*......	II. 38	,, pectoralis, *Jerd.*
306	Cyornis tickelli, *Bly.*	II. 7	
	FAMILY MERULIDÆ.		
342	Myiophoneus horsfieldi, *Vig*	I. 124	
345	Pitta brachyura, *Lin*...............	II. 285	
354	Geocichla cyanotis, *Jerd.*	II. 98	
359	Merula nigropilea, *Lafr*..........	II. 91	
385	Pyctorhis sinensis, *Gm.*...	I. 95	
385*ter.*	,, griseogularis, *Hume* ...	....	Pyctorhis altirostris, *Jerd*
389	Alcippe poiocephala, *Jerd*	I. 106	Alcippe phœocephala, *Jerd.*
390	,, atriceps. *Jerd.*	I. 109	Rhopocichla, atriceps, *Jerd.*
397	Dumetia hyperythra, *Fran.*	I. 92	
398	,, albogularis, *Bly*	I. 94	
399	Pellorneum ruficeps, *Sws*........	I. 100	
404	Pomatorhinus horsfieldi, *Syk*	I. 84	
404*ter.*	,, obscurus, *Hume* ..	....	

No and Name in Hume's Catalogue.		Reference	REMARKS.
	FAMILY MERULIDÆ—continued.		
432	Malacocercus terricolor, *Hodgs*...	I. 74	Crateropus canorus, *Lin.* in part.
433	,, griseus, *Lath.*	I. 78	,, griseus. *Gm.*
434	,, malabaricus, *Jerd.*	I. 74	,, canorus, *Lin.* in part.
435	,, somervillei, *Sykes.*	I. 80	,, somervillei, *Sykes.*
436	Argya malcolmi, *Sykes*............	I. 72	
437	Layardia subrufa, *Jerd.*	I 74	Argya subrufa, *Jerd.*
438	Chatarrhœa caudata, *Dum.*	I. 70	,, caudata, *Dum.*
439	,, earlii, *Bly*	I. 68	,, earlii, *Bly.*
440	Megalurus palustris, *Hors*........	I. 249	
441	Chætornis striatus, *Jerd*	I. 252	Chætornis locustelloides, *Bly.*
442	Schœnicola platyurus. *Jerd.*	I. 271	
443	Laticilla burnesi, *Bly*............ .	I. 247	
	FAMILY BRACHYPODIDÆ.		
446	Hypsipetes ganeesa, *Sykes*.......	I. 167	
450	Criniger ictericus, *Sid.*	I. 185	Iole icterica, *Strickl.*
452	Ixus luteolus, *Less*	I. 189	Pycnonotus luteolus, *Less.*
455	Rubigula gularis *Gould*..........	....	,, gularis, *Gould.*
457	Brachypodius poiocephalus, *Jerd*	....	Micropus phœocephalus, *Jerd.*
459	Otocompsa leucotis, *Gould.*	I. 177	Molpastes leucotis, *Gd.*
458 *bis.*	,, fuscicaudata, *Gould*...	I. 180	
462	Pycnonotus hæmorrhous, *Gm*....	I. 169	Molpastes hæmorhous, *Gm.*
463	Phyllornis jerdoni, *Bly*	I. 155	Chloropsis jerdoni, *Bly*
464	,, malabaricus, *Gm*.......	....	,, malabaricus, *Gm.*
468	Iora tiphia, *Lin*	I. 151	Ægithina tiphia, *Lin.*
468 *bis.*	,, nigrolutea. *Mar*................	....	,, nigrilutea, *Mar.*
469	Irena puella, *Lath*	I. 157	
470	Oriolus kundoo, *Sykes*	I. 354	
471	,, indicus, *Jerd*............ ..	....	
472	,, melanocephalus, *Lin*....	I. 359	
	FAMILY SYLVIADÆ.		
475	Copsychus saularis, *Lin*............	II. 80	
476	Cercotrichas macrura, *Gm*.........	II. 86	Cittacincla macrura, *Gm.*
479	Thamnobia fulicata, *Lin.*	II. 76	
480	,, cambaiensis, *Lath*....	II. 71	
481	Pratincola caprata, *Lin*	II. 41	
489	Saxicola picata, *Bly.*	II. 52	
492 *ter.*	Ædon familiaris, *Nené*............	....	
494	Cercomela fusca, *Bly*	II. 54	
515	Acrocephalus stentorius, *Ars*......	I. 224	
530	Orthotomus sutorius, *Forst*	I. 274	
532	Prinia flaviventris, *Decess*	I. 289	
534	,, socialis, *Sykes*	I. 291	
535	,, stewarti, *Bly*	I. 295	
538	,, hodgsoni, *Bly*	I. 240	Franklinia gracilis. Author
539	Cisticola cursitans, *Frankl*........	I. 236	
543	Drymœca inornata, *Sykes*	I. 301	Prinia inornata, *Sykes.*

No. and Name in Hume's Catalogue.		Reference	Remarks.
	FAMILY SYLVIADÆ—continued.		
544*bis.*	Drymœca rufescens, *Hume*	....	
545	„ sylvaticus, *Jerd*	I. 297	Primia sylvatica, *Jerd.*
545*bis.*	,, insignis	.. ..	
550	Burnesia gracilis, *Rupp*	I. 287	,, lepida, *Bly.*
551	Franklinia buchanani, *Bly*	I. 243	
553	Hypolais rama, *Sykes*	I. 254	
553*bis.*	Sylvia nana, *H. & Ehr.*	......	
589	Motacilla maderaspatensis, *Gm.*	II. 202	
600	Corydalla rufula, *Vieill*	I. 213	Anthus rufulus, *Vieill.*
	FAMILY AMPELIDÆ.		
631	Zosterops palpebrosa, *Tem.*	I. 140	
645	Parus nipalensis. *Hodgs*	I. 31	Parus atriceps.
646	,, nuchalis, *Jerd*	....	
647	Machlolophus xanthogenys, *Vig.*	I. 38	
648	„ aplonotus, *Bly*	I. 39	Machlolophus haplonotus, *Bly.*
	FAMILY CORVIDÆ.		
660	Corvus macrorhynchus, *Wagl*	I. 4	
663	„ splendens, *Vieill*	I. 8	
674	Dendrocitta rufa, *Scop*	I. 19	
678	,, leucogastra, *Gould*	I. 22	
	FAMILY STURNIDÆ.		
681*bis.*	Sturnus minor, *Hume.*	I. 370	
683	Sturnopastor contra, *Lin*	I. 386	
684	Acridotheres tristis, *Lin*	I. 377	
685	,, ginginianus. *Lath*	I. 381	
686	„ fuscus, *Wagl*	I. 383	Æthiopsar fuscus, *Wagl.*
686*bis.*	,, mahrattensis	... .	
687	Sturnia pagodarum, *Gm*	I. 374	
688	,, malabarica *Gm*	I. 372	
689	,, blythii, *Jerd*	I. 371	
692	Eulabes religiosa, *Lin.*	I. 363	
	FAMILY FRINGILLIDÆ.		
694	Ploceus philippinus, *Lin*	II. 114	Ploceus baya, *Bly.*
695	,, manyar, *Horsf.*	II. 121	
696	,, bengalensis, *Lin*	II. 120	
697	Amandina malacca, *Lin*	II. 126	Munia malacca, *Lin.*
699	,, punctulata, *Lin*	II. 141	,, punctuluta, *Lin.*
701	,, striata, *Lin.*	II. 133	,, striata, *Lin.*
703	,, malabarica, *Lin*	II. 136	,, malabarica, *Lin.*
704	Estrelda amandava, *Lin*	II. 147	Sporœginthus amandava, *Lin.*
705	,, formosa, *Lath*	II. 145	Stictospiza formosa, *Lath.*
706	Passer domesticus, *Lin*	II. 159	
709	,, pyrrhonotus, *Bly*	II. 162	
711	Gymnoris flavicollis, *Frankl*	II. 157	
720*bis.*	Emberiza striolata, *Licht.*	II. 170	
724	Melophus melanicterus, *Gm*	II. 173	

No and Name in Hume's Catalogue.		Reference.	REMARKS.
	FAMILY FRINGILLIDÆ—continued.		
756	Mirafra erythroptera, *Jerd*	II. 231	
757	,, cantillans, *Jerd*	II. 227	
758	Ammomanes phœnicura, *Fr*	II. 240	
759	,, deserti, *Licht*	II. 242	Ammomanes phœnicuroides, *Bly*.
760	Pyrrhulauda grisea, *Scop*	II. 243	
760*bis*.	,, melanauchen, *Cat*.	II. 248	
761	Calendrella brachydactyla, *Leisl*.	....	
762*ter*.	Alaudula adamsi, *Hume*	II. 226	
765	Spizalauda deva, *Sykes*	II. 236	Galerita deva, *Sykes*.
765*bis*.	,, malabarica, *Scop*	II. 237	,, malabarica, *Scop*
767	Alauda gulgula, *Frankl*	II. 221	
770	Alœmon desertorum, *Stan*	II. 219	
	ORDER GEMITORES. FAMILY TRERONIDÆ.		
773	Crcopus chlorigaster, *Bly*	II. 327	
774	Osmotreron bicincta, *Jerd*	II. 374	
775	,, malabarica, *Jerd*	II. 375	
780	Carpophaga aënea, *Lin*	II. 366	
781	,, insignis, *Hodgs*	II. 368	
	FAMILY COLUMBIDÆ.		
788	Columba intermedea, *Strickl*	II. 344	
788*bis*.	,, livia, *Bp*	II. 344	
792	Turtur pulchratus, *Hodgs*	II. 349	Turtur pulchrala, *Hodgs*.
793	,, meena, *Sykes*	II. 350	
794	,, senegalensis, *Lin*	II. 351	
795	,, suratensis, *Gm*	II. 353	
796	,, risorius, *Lin*	II. 357	
797	,, tranquebaricus, *Lin*	II. 359	
798	Chalcophaps indica, *Lin*	II. 363	
	ORDER RASORES. FAMILY PTEROCLIDÆ.		
799	Pterocles arenarius, *Pall*.	III. 366	
800	,, fasciatus. *Scop*.	III. 364	
801	,, alchata, *Lin*.	....	
801*bis*.	,, senegalus, *Lin*.	III. 366	
801*ter*.	,, coronatus, *Licht*	III. 366	
802	,, exustus, *Tem*	III. 361	
	FAMILY PHASIANIDÆ.		
803	Pavo cristatus, *Lin*	III. 405	
813	Gallus sonnerati, *Gem*.	III. 420	
814	Galloperdix spadiceus, *Gm*	III. 423	
815	,, lunulatus, *Val*	III. 425	

No. and Name in Hume's Catalogue.		Reference.	REMARKS.
	FAMILY TETRAONIDÆ.		
818	Francolinus vulgaris, *Steph.*	III. 428	
819	,, pictus, *Jerd. and Sel.*	III. 430	
820	Caccabis chukor, *Gray.*	III. 431	
821	Ammoperdix bonhami, *Gray.* ...	III. 433	
822	Ortygornis pondiceriana, *Gm.* ...	III. 435	
826	Perdicula asiatica, *Lath.*	III. 440	
827	,, argoondah, *Sykes.*	III. 441	
828	Microperdix erythrorhynchus, *Sykes*	III. 442	
829	Coturnix communis, *Bonn.*	III. 443	
830	,, coromandelica, *Sykes*...	III. 444	
	FAMILY TINAMIDÆ.		
832	Turnix taigoor, *Sykes*..............	III. 367	
834	,, joudera, *Hodgs*............	III. 370	Turnix tanki, *Buch Ham.*
835	,, dussumieri, *Tem.*	III. 371	
	ORDER GRALLATORES. FAMILY OTIDIDÆ.		
836	Eupodotis edwardsi, *J. E. Gr.*...	III. 375	
837	Houbara macqueeni, *J. E. Gr.*...	....	
839	Sypheotides aurita, *Lath.*........	III. 380	
	FAMILY CURSORIDÆ.		
840	Cursorius coromandelicus, *Gm.*...	III. 323	
840*bis.*	,, gallicus, *Gm.*	III. 325	
	FAMILY GLAREOLIDÆ.		
842	Glareola orientalis, *Leach*	III. 319	
842*bis.*	,, pratincola, *Lin.*	III. 318	
843	,, lactea, *Tem.*	III. 320	
	FAMILY CHARADRIDÆ.		
848	Ædicnemus scolopax, *S. G. Gm.*	III. 331	
849	Ægialitis cantianus, *Lath.*	III. 338	
850	,, dubia, *Scop.*	III. 340	Ægialitis jerdoni, *Tem.*
855	,, minuta, *Pall.*...........	III. 340	
856	Lobivanellus indicus, *Bodd.*	III. 345	
858	Lobipluvia malabarica, *Bodd.* ...	III. 335	
859	Esacus recurvirostris, *Cuv.*	III. 337	
	FAMILY HÆMATOPIDÆ.		
861	Dromas ardeola, *Payk.*	III. 327	
	FAMILY GRUIDÆ.		
865	Grus antigone, *Lin.*	III. 372	

No. and Name in Hume's Catalogue.		Reference.	REMARKS.
	FAMILY SCOLOPACIDÆ.		
873	Rhynchæa bengalensis, *Lin.*	III. 350	Rhynchæa capensis, *Lin.*
893	Tringoides hypoleucos, *Lin.*	III. 352	
	FAMILY HIMANTOPIDÆ.		
898	Himantopus candidus, *Bp.*	III. 353	
	FAMILY PARRIDÆ.		
900	Parra indica *Lath.*	III. 356	Metapodius indicus, *Lath.*
901	Hydrophasianus chirurgus, *Scop.*	III. 358	
	FAMILY RALLIDÆ.		
902	Porphyrio poliocephalus, *Lath*	III. 384	
903	Fulica atra, *Lin.*	III. 386	
904	Gallicrex cinereus, *Gm.*	III. 387	
905	Gallinula chloropus, *Lin.*	III. 389	
907	Erythra phœnicura, *Fr.*	III. 391	
908	Porzana akool, *Sykes*	III. 398	
910	,, bailloni, *Veill.*	III. 395	Porzana pusilla, *Pall.*
913	Hypotœnidia striata, *Lin.*	III. 399	
	FAMILY CICONIDÆ.		
917	Xenorhynchus asiaticus, *Lath.*	III. 265	
920	Dissura episcopa, *Bodd*	III. 268	
	FAMILY ARDEIDÆ.		
923	Ardea cinerea, *Lin*	III. 233	
924	,, purpurea, *Lin.*	III. 235	
925	Herodias alba, *Lin.*	III. 237	
926	,, intermedia, *Hass.*	III. 240	
927	,, garzetta, *Lin.*	III. 242	
928	Demi-egretta gularis, *Bosc*	III. 244	
929	Bubulcus coromandus, *Bodd*	III. 247	
930	Ardeola grayii, *Sykes*	III. 248	
931	Butorides javanica, *Horsf*	III. 249	
932	Ardetta flavicollis, *Lath*	III. 251	Ardeiralla flavicollis, *Lath.*
933	,, cinnamomea, *Gm.*	III. 252	
934	,, sinensis, *Gm.*	III. 255	
935	,, minuta, *Lin.*	III. 257	
937	Nycticorax griseus, *Lin.*	III. 258	Nyctiardea nycticorax, *Lin.*
	FAMILY TANTALIDÆ.		
938	Tantalus leucocephalus, *Forst.*	III. 220	
939	Platalea leucorodia, *Lin.*	III. 217	
940	Anastomus oscitans, *Bodd*	III. 224	
941	Ibis melanocephala, *Lath.*	III. 226	
942	Inocotis papillosus, *Tem.*	III. 228	
943	Falcinellus igneus, *Gm.*	III. 231	Plegadis falcinellus, *Lin.*

No. and Name in Hume's Catalogue.		Reference.	REMARKS.
	ORDER NATATORES. FAMILY PHŒNICOPTERIDÆ		
944	Phœnicopterus antiquorum, *Lath.*	....	
944*bis.*	„ minor, *G. St. Hill.*	....	
	FAMILY ANSERIDÆ.		
950	Sarcidiornis melanonotus, *Penn.*	III. 282	
951	Nettopus coromandelianus, *Gm.*	III. 280	
952	Dendrocygna javanica, *Hors.*	III. 284	
953	„ fulva, *Gm.*	III. 286	
	FAMILY ANATIDÆ.		
959	Anas pœcilorhyncha, *Forst.*	III. 289	
960	Rhodonessa caryophyllacea, *Lath.*	III. 290	
961*bis.*	Chaulelasmas angustirostris, *Mén.*	III. 291	
	FAMILY PODICIPIDÆ.		
975	Podiceps minor, *Lin.*	III. 401	Tachybaptes fluviatilis, *Tunst.*
	FAMILY LARIDÆ.		
981*ter.*	Larus hemprichi, *Bonap.*	III. 293	
981*quat.*	„ gelastes, *Licht.*	III. 294	
982	Sterna caspia, *Pall.*	III. 295	
983	„ anglica, *Mon.*	III. 304	
985	„ seena, *Sykes.*	III. 308	
987	„ melanogastra, *Tem.*	III. 310	
987*bis.*	„ albigena, *Licht.*	III. 311	
988*ter.*	„ saundersi, *Hume*	III. 314	
989	„ bergii, *Licht.*	III. 297	
990	„ media, *Horsf.*	III. 299	
990*bis.*	„ cantiaca, *Gm.*	....	
992	„ anæstheta, *Scop.*	III. 300	
992 *bis.*	„ fuliginosa. *Gm.*	III. 303	
995	Rhynchops albicollis, *Sws.*	III. 316	
	FAMILY SULIDÆ.		
1001*bis.*	Pelecanus onocrotalus, *Lin.*		
	FAMILY GRACULIDÆ.		
1005	Phalacrocorax carbo, *Lin.*	III. 270	
1006	„ fuscicollis, *Supth.*	III. 272	
1007	„ pygmæus, *Pall.*	III. 273	
1008	Plotus melanogaster, *Penn.*	III. 274	

THE BUTTERFLIES OF THE CENTRAL PROVINCES.

By J. A. B.

Part V.

(*Continued from Vol. VI., page 183.*)

FAMILY IV., PAPILIONIDÆ.

Subfamily 1, Pierinæ.

86. *Nichitonia xiphia,* Fabricius.* We now come to the subfamily known as the "Whites," of which the butterfly named above heads the list, so far as the Central Provinces is concerned. It is very like what is known as the "Wood-White" at home. Its wings are not so narrow, however, and are more rounded. It is pure white, with the exception of two dark brown or black marks—one at the apex and another spot near it—both on the forewing. Underneath the inner spot is reproduced, while the mark at the apex is wanting. The hindwing underneath bears a few faint greenish marks or striæ. It is a very feeble little creature, and seems to prefer shady nooks and lonely glades in forests.

87. *Terias hecabe,* Linnæus. This is one of the commonest of Indian butterflies, sharing with *D. chrysippus* the honour of being found all over India. The least observant person must have noticed it at any time he may have taken a walk, except perhaps in the very hottest or in the very coldest weather. It is a small bright yellow butterfly, with a black border to the wings, which is deeper on the forewing than on the hindwing. The border on the forewing is irregular and deeply indented. The caterpillars of all the species of this genus, as far as is known, are pale green, and so are the chrysalides usually. Sometimes, however, they assume different colours, assimilating themselves to the surroundings on or near which they are suspended. The chrysalis is a queer looking object: the wing-cases forming a deep keel, and the palpi-cases produced into what looks like a long and pointed snout.

The underside of this butterfly is subject to many variations—in the hot weather it is sometimes almost entirely pale yellow, while in the rains it is marked with lines and splashes of a reddish colour, and in some specimens there is a very large rust-coloured splash on the costa close to the apex of the forewing.

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* The numbers in brackets after the name of each butterfly have now to be omitted, as we have got beyond the published portions of "The Butterflies of India, Burmah and Ceylon," by Mr. Lionel de Nicéville.

88. *Terias æsiope*, Ménétriés. This is very like the former butterfly, but the black border to the wings is more even, and that on the forewing is not so much indented. The marks on the underside differ, being more of the nature of streaks and of a black colour.

89. *Terias rubella*, Wallace. This is very like the last, but the black border to the wings has a distinct brick-dust-red fringe, and the veins on the hindwing are defined with yellow, as they pass through the border. The wings underneath are fringed with a narrow reddish border.

90. *Terias læta*, Boisduval. At first sight this closely resembles the butterflies of this genus already described, but it can be at once distinguished by the different shape of the forewing at the apex, which is pointed instead of being rounded as in the others. The hindwing underneath is marked in quite a different manner, being more or less clouded all over with a reddish-brown hue, which is concentrated in two places into bars, the upper of which is longer than the lower. The male has a differently-shaped and placed "sexual mark" to species of the *hecabe* group. All the four butterflies just described are very common and are found everywhere. They have a weak flight and are easily captured. They sometimes settle in swarms on damp spots on the ground. The larvæ feed on various kinds of leguminous plants.

91. *Terias harina*, Horsfield. I have captured only one specimen of this species. It is a larger butterfly than those already described and is altogether of a lighter colour, bearing the same relation in this respect to its congeners as the "clouded-yellow" and "pale clouded-yellow" do at home. While the others remind one of the colour of the Indian oriole, *Oriolus kundoo*, this reminds one of the colour of a primrose. The only relief to the uniform pale yellow is a dark tip to the forewing on the upperside. I took one specimen in Kalahandi. It has no "sexual-mark" in the male.

92. *Catopsilia catilla*, Cramer. The butterflies of this genus are very common, each of the four species to be mentioned being about equally so. *C. catilla* is the largest of these to be found in the Central Provinces. The males are pale yellow, almost white, but this deepens

towards the inner portion of the wings near the body. There is a slight black tip to the forewing, which is continued as a narrow border some way along the costa or upper margin and also on the outer margin, but here the black is rather disconnected. The thorax is clothed with silky hairs, which are longer near the abdomen. There are also some long silky hairs on the hindwing near the body. On the inner margin of the forewing there is underneath a kind of brush formed of the same kind of silky hairs, and on the corresponding upper portion of the hindwing there is an oval patch of scales closely pressed together and of a different structure to the scales which form the colouring of the wings, for these appear under the microscope to be hollow like bladders, whereas the ordinary scales are flat and tile-like. The underside of the wings is always marked with reddish streaks, and on the forewing (underside) there is one silver-pupilled ocellus encircled with red, while on the hindwing (underside) are two similar ocelli. The use of the peculiar brush and patch of scales on the wings is not known, but all the males of this genus possess them. In fresh specimens there is a peculiar faint perfume something like primroses to be observed in the male only. The female is of a deep rich yellow, the forewing with a similar border as in the male, with the addition of a black spot in the middle of the wing; underneath the markings are more decided and of a richer tint. In some specimens the ocelli are surrounded by a richly coloured patch, in which pink, brown and lilac are mingled. The antennæ are pink. The flight cf all the butterflies of this genus is very vigorous, and they always settle with their wings closed.

93. *Catopsilia crocale*, Cramer. The male of this species is on the upperside very much like that of the last, but is rather more pervaded with yellow. It is not quite so large as a rule, and the black tip and border to the forewing are slightly more perceptible. The underside is almost unmarked and of a pure yellow, slightly paler on the forewing, where it is covered by the hindwing when the butterfly is at rest. The female has more black than any other of the genus, as both wings are bordered with that colour, and there is a sort of inner border formed by a series of dark marks, while the base of the forewing in some specimens is suffused with black.

There is also an indentation from the border on the forewing from the costa, marking the place where the discoidal cell ends. The underside is not of so pure a yellow as in the male, and there is a kind of sheen upon it. The caterpillar feeds on various leguminous plants, the chief being the "ámaltás" (*Cassia fistula*), or the Indian Laburnum, a beautiful tree with its long drooping clusters of pale yellow flowers, followed in due time by long black pods like ebony rulers, only not quite so straight. The first thing the caterpillars do on changing their skins is to eat that cast-off garment. The chrysalis is usually pale green, but assumes other colours when near objects which it desires to resemble for the sake of concealment. The antennæ are darker than in the foregoing species.

94. Catopsilia pyranthe, Linnæus. The male of this butterfly is white with a faint greenish tinge. It has the black border and tip as described in the former species, and in addition there is a black spot at the end of the discoidal cell in the forewing. Underneath it resembles *C. crocale*, except that both wings have faint streaks of a darker colour all over them. The female is the same, except that the border to the wings on the upperside is deeper and extends from the base of the forewing to the inner margin of the hindwing, and there is as if an attempt had been made on the forewing to begin an inner border, but the effort had ended half-way. The underside has the same sheen as is found in *C. crocale.* The caterpillar and chrysalis closely resemble those of the last species, and it feeds also on leguminous plants. The antennæ are dark.

95. Catopsilia gnoma, Fabricius. The male of this butterfly is white, the border and tip to the forewing being less broad than in the species already described; there is a black spot on the upperside of the forewing at the end of the cell. Underneath the coloration and markings closely resemble those of *C. pyranthe*, but both wings have a reddish spot at the end of the cell. The female looks like a pale specimen of the female of *C. catilla*; but the underside is marked all over with streaks like *C. pyranthe.* On the forewing (underside) there is an ocellus at the end of the cell, and on the hindwing (underside) there are three silver-pupilled ocelli, the largest within the cell, and one of the two others on the nervules defining the cell, while the third is just beyond the cell. The last two ocelli are of about equal size. It is more than probable that *C. pyranthe* is the dry-season form and *C. gnoma* the wet-season form of one species, which will stand under the former name.

96. *Belenois mesentina*, Cramer. This butterfly is very common in parts of the Central Provinces. It is a variable insect in the depth of its colouring. The upperside is white. The forewing has a black bar across the apex of the wing, which is bordered with black, and between the bar and the apex the veins are marked with black, so that the white ground is broken up into spots. There is also a black mark like a comma reversed, defining the end of the cell on the forewing. The hindwing has a scalloped border in black. Underneath, the black markings are all more defined, and the veins of the hindwing are clearly marked with black. In some specimens the underside is quite pale, in others it is more or less suffused with pale orange, which is more decided over the hindwing and the apex of the forewing. In the female the markings are all more defined than in the male. The caterpillar and chrysalis are both pale green. The caterpillar feeds on a thorny plant with small leaves, the name of which I do not know.

97. *Huphina phryne*, Fabricius. This is also a very variable species. It is difficult to describe the varieties so as to bring them within the scope of an unscientific paper as this professes to be. It very much resembles the last butterfly in colour and habits, but its forewing is a little more rounded than in *B. mesentina*, and the black mark on the forewing defining the cell is not found in *H. phryne* except in the specimens occurring after the rains, when the whole cell is defined as well as the rest of the veins with black. The specimens taken in the winter and hot weather are altogether paler than those taken in the rains and early autumn. The latter have the veins distinctly marked, especially on the underside, and the wings are bordered with black, while the yellow suffusing the ground-colour is of a richer tint. In the pale specimens the yellow sometimes is only just a tinge of colour over the white. The female at all seasons is darker altogether than the male. Both *B. mesentina* and *H. phryne* frequent hedgerows and low bushes, and settle constantly.

98. *Catophaga paulina*, Cramer. The male of this butterfly is pure white unrelieved by any other colour with the exception of a

suspicion of a faint black border at the apex and outer margin of the forewing. Its forewing is of a pointed and elegant shape. I only possess one specimen captured by myself at Saugor.

99. *Nepheronia gœa,* Felder. This is a beautiful creature. The male is of a delicate pale blue, the wings bordered and the veins defined with black. The female is paler blue, with all the black markings deeper and broader. Underneath, in good specimens, there is a sheen on the wings like mother-of-pearl. Some specimens have the hindwing suffused with yellow. This variety has been called *N. hippia.* The female is a good mimic of *D. limniace.* This butterfly frequents shady woods and glades, and seems to have paths of its own. I have often watched the males with their elegant flight flitting along through the mazes of the jungle, and have noticed that they invariably return the way they went, repeating the trip over and over again. The females are less active, and prefer resting in shady nooks and corners. This lovely butterfly is like the embodiment of some sweet, shy, wood-nymph clad in the colours of a waterfall deep hid among the sequestered shades of its own wild domain.

100. *Delias eucharis,* Drury. This is a well-known, common and distinctively-coloured butterfly. The ground-colour is pure white with all the veins clearly marked with black, especially on the forewing. A short distance from the outer margin of the wings there is a black line forming a sort of inner border. The female has all the black markings darker and more distinct. In some specimens the dark markings almost cover up the white, so that the butterfly looks as if it were almost black. Underneath, the veins and inner line are all clearly defined in both sexes. The forewing has the apex suffused with yellow, which is more distinct in the female than in the male. The hindwing is also suffused with yellow as far as the inner border, and it is further adorned with a border of brilliant scarlet spots bordered internally with black, the shape of the petals of a flower, the broad ends pointing inwards. *D. eucharis* is a very early riser and may be seen, before any other butterfly begins to stir, making its way with a slow flapping flight through the topmost boughs of high trees. It is easily captured, and can be seen almost the whole year round.

101. Delias indica, Wallace. This butterfly very much resembles *D. eucharis,* but lacks in both sexes the inner dark line or border to the outer margin of the wings, and the red spots on the underside of the hindwing are not bordered internally with black. The female in some specimens shows the yellow at the apex of the forewing on the underside through, so that it is perceptible on the upperside. It seems to be more of a jungle-loving insect than *D. eucharis,* which latter largely frequents gardens.

102. Ixias marianne, Cramer. This looks like an enlarged edition of the European "Orange-tip" (*Euchloë cardamines*) at first sight. Its flight, however, is much more rapid and stronger, and it is altogether a more robust creature. The ground-colour is pure white, enriched on the forewing by a brilliant orange patch at the apex of the wing, which is bordered internally by a black line. The wings are bordered with black also. The female has a few small black spots in the orange patch. Underneath it is of a pale yellow, with the orange patch on the forewing showing through faintly. On the forewing there is a black spot or ocellus with a white centre, which shows through on the upperside as a kind of black notch on the inner border already mentioned. There is also a row of rust-coloured spots between this ocellus and the outer margin on the underside of the forewing. The underside of the hindwing has a curved row of whitish spots bordered with brown, and there are also a brownish spot on the costa and a white-centred brown spot on the vein defining the discoidal cell on the hindwing. It has an irregular flight like that of *H. phryne* or *B. mesentina,* and flits along hedges and ditches.

103. Ixias pyrene, Linnæus. This is very like *I. marianne,* but the ground-colour is yellow while in *I. marianne* it is white.

104. Callosune danäe, Fabricius. This is also like the English "Orange-tip," but instead of having orange tips to the forewing, it has a crimson tip, which in some lights assumes a faint purple tinge. It has a black border to both wings, and the crimson tip is also bordered on the inside with black. Underneath the tip of the forewing is yellowish, and there is a curved row of black spots about the middle of this yellow space, and a black spot on the disco-cellular nervules. There are also two blackish spots below this row and close to the outer margin of the wing. There is also a curved row of black spots on the hindwing, and a black spot centred with pink at the end of the discoidal cell. It is also fond of hedgerows and ditches, and settles on damp spots. I have found it in Nagpur where it is common, but have come across it nowhere else in the Central Provinces. The female has a few black marks showing on the crimson tip, which are similarly disposed as the row of spots on the underside of the wing.

105. Callosune (Sp.?) I have several specimens of a butterfly very much like *C. danäe*, but very much smaller. The colouring is not so bright as in *C. danäe*, as the black border is wanting in both wings. I captured this at Burhanpur, and have seen it nowhere else.

106. Callosune (Sp.?) I have also several small orange-tipped butterflies belonging to this genus of which I do not know the names. They were taken at Hoshangabad, Singanama, and Kesla. They are most delicate lovely little creatures.

107. Callosune (Sp.?) I took several specimens of a *Callosune* in company with those taken at Burhanpur. It is yellowish-white with a deep black border to the wings, and there are a few whitish spots in the black border at the apex of the forewing. Underneath it is yellow, and the forewing has a few black spots on it. I do not know its specific name.

SUBFAMILY II. PAPILIONINÆ.

108. Papilio polymnestor, Cramer. I begin the subfamily with this butterfly as it is the largest I have captured in the Central Provinces. The expanse of its wings is sometimes fully six inches. Its colours are velvetty-black and azure-blue disposed on the forewing in a band of blue commencing near the anal angle of the wing near the outer margin, and running towards the upper margin where it, in some specimens, curves inwards. The blue band narrows rapidly as it runs upwards. The rest of the wing is pure black. The hindwing is much more richly decorated. There is only a triangular black patch at the base of the wing, the rest is bright azure, and bears two rows of black spots. The spots in the upper row are somewhat pear-shaped, in the lower row they are more circular.

Each vein, moreover, is tipped with black. Underneath, near the base of the wings, are some oval dull red spots, which in some specimens show through on the upperside. The female is as a rule larger and the blue colour is paler. The dull red spots at the base of the wings in the female are seen plainly on the upperside as well. Although it belongs to the "swallow-tail" family, this butterfly is devoid of tails, and the wings are narrow and long not deep and broad. The flight of this glorious butterfly is on a par with its size and beauty of colouring. It shows, as might be expected, great power, and sails along majestically. It seems fond of a moist climate and of forest glades and old gardens where the vegetation is rich and luxuriant. The time of the day it is most likely to be about is from about 8 till 10 o'clock in the morning. After this it takes a siesta and may be found in company with other butterflies, chiefly "swallow-tails," also resting with wide-spread wings in some shady and secluded spot. I witnessed the rather peculiar capture of one of these beauties on one occasion by a Mahomedan lad who was out with me. We were in an old garden surrounded by thickets of the Female or Kattang Bamboo, and full of guava, mango, lime, orange and custard-apple trees. On one side of the garden was a large tank overgrown with white, red and blue water-lilies, the Lotus of India; on the other side was a road shaded by bamboos and mango trees, and beyond the road a large river. The place was an ideal one for butterflies, and numerous specimens of many varieties were flitting about. Every now and again a *P. polymnestor* or *P. crino* would appear and be at once given chase to. We found, however, that as a rule they all seemed to affect a particular path of their own, and were constantly passing up and down their own road among the trees. We therefore gave up chasing them and waited till they came back, when a rapid onslaught was made, sometimes successfully, sometimes otherwise. In the latter case our thoughts at missing such prizes were too deep for utterance. At last the boy aforesaid made a swoop with his net at a fine *P. polymnestor*, but instead of being secured within the folds of the net, the insect fell fluttering to the ground. The boy fell upon it, and finding it was a good specimen, he added it to those he had already caught. When our time was up to go back home, I examined the butterfly, and found that the strong nerve or rib of the costa of the forewing was broken completely across. The butterfly was going in the opposite direction to that in which the swoop was made, and coming in contact with the cane of the net had been disabled in the manner described. I have only obtained this butterfly in the Central Provinces from the Sambalpur District, and from Kalahandi and Bastar. An easy way to catch *P. polymnestor* and other quick-flying, wandering, seldom-settling butterflies, is to place a captured specimen (dead of course) on the ground with open wings in their path of flight. Every specimen passing that way will stop an instant or more to examine the specimen on the ground, and give a chance of a shot.

109. Papilio crino, Cramer. This is another glorious creature resplendent in velvetty black and iridescent green. The colours are disposed in somewhat the same manner as in *P. polymnestor*, but the wings are deep and broad, and each hindwing is adorned with a lobed tail bearing a brilliant green. spot. The green on the wings of this butterfly changes according to the light in which it is seen, from an intense brilliant emerald green to an equally intense and brilliant sapphire blue. The black of the wings is more or less irrorated or dusted over with green scales of the same colour. Underneath the colours are very sober—a dull sooty-black being the prevailing colour, relieved by a row of pinkish eyes on the hindwing. It has very much the same habits as *P. polymnestor,* but the effect of the changing colours on the wings as it flies along is indescribably beautiful. The green and blue flash out with a radiance I have never seen equalled, and the impression to the sense of sight is one of overpowering beauty. It is from this very fact I have captured so few, for when I have seen them I have been so absorbed in admiring their loveliness and watching their movements that most I have seen have been allowed to go free. In fact I have only brought myself to catch the first I ever saw; the novelty was so great, I could not resist the innate impulse of adding it to my collection. I have received one from Bastar, and these two are all I possess. One met with an unfortunate accident, but though shattered and pieced together it still is an object of admiration. Its habitat in the Central Provinces is the same as *P. polymnestor.*

110. Papilio dissimilis, Linnæus. This is a very good mimic of *Danais limniace*, but the ground-colour is more yellow than blue. It is probable that this and *P. panope*, which is as good a mimic of *Euplœa core*, are one and the same species. The ground-colour in *P. dissimilis* is pale yellow, in *P. panope* it is deep brown. They both have the habit of settling on the extreme end of dry twigs just the same as do the butterflies they mimic. When startled, their flight is rapid and powerful, otherwise it resembles that of *D. limniace* and *E. core* in its ease, elegance, and general demeanour of lazy gracefulness. They are both tailless species.

111. Papilio panope, Linnæus. This insect has been touched upon in the preceding paragraph.

112. Papilio erithonius, Cramer. This is a very common butterfly, almost rivalling the genus *Catopsilia* in its ubiquity. It is a very handsome insect, and resembles superficially the English "swallow-tail," *P. machaon*. The colours are the same, but somewhat differently disposed, the black prevailing more than in the English butterfly. It, however, lacks the series of blue spots on the hindwing, which is such an attractive feature in *P. machaon*, and also has no tail to the hindwing. The larva affects the trees of the orange tribe, and a careful search is sure to reveal some of them on any orange, lime, pomolo or citron tree in the garden. When young it resembles the droppings of some small bird, but after the second or third change of skin it assumes a dark green colour like the leaf it feeds on, and is marked transversely with dark bars relieved by white. When irritated the caterpillar, in common I believe with all others of this genus, has the power of protruding from a point just behind the head—the nape of the neck as it were—a forked process of a reddish colour and translucent. It looks like a bit of coloured gelatine, and is flexible and covered with a moist exudation of a peculiar and penetrating odour, somewhat resembling the scent of oranges. It also feeds on a common weed called Bemchi or Bewachi in this part of India by the country people. The botanical name of this plant is *Psoralea coryllifolia*, and it grows plentifully upon the bunds of tanks. It is a marked feature in the larvæ of the "swallow-tails" that they are all found feeding on the upper surface of leaves. It would appear as if there were two varieties of this butterfly,—one a pale yellow, while the other is of a darker colour. As far as I can speak from experience, the pale ones are the fresh specimens while he darker ones are older ones, for when captured the darker ones are generally more ragged than their paler brethren. I do not remember to have seen any dark ones produced from the numbers of larvæ that I have had in confinement. There is no doubt that *P. erithonins* is a very variable species, varying not only in the above-mentioned feature, but in the disposition of the yellow and black markings, and also in the eye-spots at the anal angle and apex of the hindwing of both upper and undersides. This butterfly has a vigorous and bold flight. The egg is globular and smooth and of a pale yellow colour. It is easily found on the tender and young leaves and shoots of the trees mentioned above.

113. Papilio polytes, Linnæus. This and *P. pammon* are one and the same species. It is the common black and white "swallow-tail" to be found almost everywhere. The prevailing colour is black or very deep brown, and in the male this is relieved by a border of white or pale yellowish spots to the forewing and a line of larger similar spots on the hindwing. On the underside the colouring is much the same, but there are in addition on the hindwing a few reddish and blue markings. It has three forms of female—the first almost exactly resembles the male, the second is a mimic of *P. aristolochiæ*, and the third imitates *P. hector*. All four forms, that is one male and three females, have a spatulate tail to each hindwing. The second form of the female has a series of brick-red or claret-coloured marks following the direction of the margin of the hindwing, and there is a conspicuous white patch in the middle of that wing. The ground-colour of the forewing, which is black or dark brown, is much paler on the outer half; underneath the colouring is much the same as above, but paler in the forewing and brighter in the hindwing. The third form of the female has on the forewing two broad white bars at about right-angles to the costa of the wing. The inner bar is broader and longer than the outer. The hindwing has the white patch in form No. 2 replaced by a claret-coloured patch. The colouring underneath is very much the same as it is above. The larva of this butterfly resembles that of *P. erithonius* very closely, but is rather paler in tone I think. It also feeds on trees of the orange tribe. The chrysalis is much the same as in *P. erithonius*; the points on the head are more produced, and it has, as it were, elbows about the middle. In both of these species the chrysalides are very variable in colour. I have reared green, black or dark ashy, grey mottled with brown, green and grey, and pale pink ones. When disturbed the chrysalis has the property of moving the body with a jerk and emitting a faint creaking sound.

114. Papilio aristolochiæ, Fabricius. The ground-colour of this butterfly is very deep blue almost approaching black in its depth in fresh specimens. In faded specimens the colour is browner. On the hindwing there is a white patch surrounded by a few pale red marks. Underneath, the colour of the forewing is the same as above, of a dark blue or brown approaching black in its depth; but the hindwing has a white patch in the centre which is surrounded by brilliant scarlet spots. It can be distinguished from its mimic, the female of *P. polytes*, at once by its having a scarlet and black body and head. The hindwing is also adorned by a spatulate tail. It appears that this butterfly is naturally protected by an odour which pervades its body, and is therefore mimicked by other butterflies. The shape of the wings is peculiarly elegant, the forewing being long and narrow, and the hindwing being long and narrow in the opposite direction. It has a peculiar fluttering kind of flight.

115. Papilio hector, Linnæus. This grand butterfly resembles the preceding one in general shape and manner of flight, but it is altogether larger and more brilliantly coloured. The ground-colour is of a deeper tone of blue even than in *P. aristolochiæ.* The forewing is adorned with two conspicuous white bars arranged as in the third form of the female of *P. polytes,* its mimic. The hindwing has two rows of brilliant scarlet spots or half moons following the bend of the margin of the wing, and each hindwing has a rather narrow tail in addition. The wings are further bordered by a very narrow white band. The underside is just the same as the upper. The appearance of this butterfly is very rich and striking.

116. Papilio nomius, Esper. This is a very delicate fragile-looking "swallow-tail," of extremely elegant appearance. The ground-colour is pale green—"*eau de nil*" I suppose it would be called by ladies. The forewing is bordered with black on the outer margin, and about the middle of this border there is a row of diamond-shaped spots. There are five black bars on the forewing parallel to the body, the two inner ones extending across the wing and running down the anal angle of the hindwing, which has also a black border on the outer margin relieved by a few moon-shaped markings, and ending in a patch of greyish scales. The hindwing has further a long, very narrow, black-bordered, white tail. The ground-colour of the underside is pale green, with all the markings which are black above tinged with a bronzy hue beneath. The inner stripe on the hindwing is reddish-brown, the outer one consists of a series of pink markings ending in a curve at the bottom. At the anal angle of the hindwing are three grey and black "eye spots." It is fond of scrub jungle, and, in common with many other butterflies of this and other genera, is often seen seated on the ground in damp spots sucking up the moisture. It also affects nalas. It is very common at the foot of the Pachmarhi Ghât, near Singanama, where there is a hot spring. All along this spring it can be seen in quantities, and is so very tame that it will settle on your hat or clothes as you walk along the banks of the stream.

NOTES ON NIDIFICATION IN KANARA.

By J. Davidson, Bo. C.S.

(*Read before the Bombay Natural History Society, on 9th Dec.* 1891.)

I was stationed for 18 months in Kanara, in 1889 and 1890, and as it is possible I may never be there again, I send you a few notes on nidification in that district. These were made subsequently to Mr. Barnes' paper in your columns.

111.—THE GHAT NIGHT-JAR.

Caprimulgus atripennis, Jerd.

This Night-Jar is not uncommon in Kanara, but it is very shy, and only commences to call well after sunset; it is therefore a difficult bird to procure even where it is by no means scarce. The first nest I obtained was a happy termination to a whole host of misfortunes. On

April 5th, 1890, one of my servants found a single Night-Jar's egg laid on the bare ground under a bamboo clump, in thin jungle, within a hundred yards of a travellers' bungalow above the ghâts. As the markings on the egg almost certainly showed it belonged to this species, I was anxious to obtain the bird, and gave the strictest orders that no one was to go near the nest till the middle of next day. On my returning from a morning's ride, my feelings were perturbed by my dog boy smilingly informing me that there were now two eggs, and while I was preparing for my ablutions, they were further ruffled by a villager bringing in two eggs of the same type. I asked where he got them. His answer was, "quite close." He was ordered to show the place, and I followed after a very hurried toilet. To my dismay he pointed out the identical spot I had so carefully marked down. I rushed back to the bungalow for the eggs, only to find my skinner had already drilled a hole in each, and had almost finished blowing one. Having snatched them away, I replaced them, and they were soon glued to the ground. In an hour the bird was again announced as sitting. She, however, sat till I was quite close, and then dodged through trees, and after half an hour's pursuit I returned without a shot. In a couple of hours she was again on the nest, and I tried to drive her, but she broke back. I waited till 4, and, as she did not return, I nearly gave up all hope, and took away one of the eggs, leaving the other as a last chance. Just as it got dark she again returned. I fired at her with a small specimen gun as she sat on the nest, and fortunately secured her without injuring the other egg. I obtained another nest the following day, also with two fresh eggs. The eggs differ a good deal from any other Night-Jars' eggs I know. They are a rich cream-colour with a few small black or dark-purple spots on them.

120.—THE EGYPTIAN BEE-EATER.

Merops quinticolor, Vieill.

This Bee-Eater I did not notice in Kanara in the summer of 1889, but from December, 1889 to April, 1890, I noticed it in most places where there was heavy jungle and water. I took many nests between the 21st March and the 7th of April; the nest-holes were generally from 3 to 5 feet deep, and were placed on river banks, and in all cases singly; the number of eggs was 4 or 5 in each case. They appear to me indistinguishable from those of *Alcedo bengalensis*.

122.—THE BLUE-NECKED BEE-EATER.

Nyctiornis athertoni, Jerd. and Selby.

This is a very shy bird, and not at all common anywhere I visited: I noticed it, however, occasionally both above and below the ghâts from February to July, and it is probably found throughout the year. I obtained several nests; these were, as might have been expected in an orthodox bee-eater, all in holes in banks, most frequently adjoining roads; they were as a rule very deep, sometimes over 6 feet, and were at once recognizable by the fact that the tunnel always contained many wing-cases and other remains of bees, wasps, and beetles. The holes ended in a large chamber, completely filled with these remains, and the eggs were completely hidden beneath them. I carefully extracted the contents of a nest in which the eggs were hard set, and, with a slight admixture of earth, it nearly filled the top of a "solah topee" Three and four were the number of eggs and young I found in the nests; they are quite indistinguishable from those of *Halcyon smyrnensis*; fortunately, however, both the blue-necked and chestnut-headed bee-eaters allow themselves to be dug out, so there can never be any doubt about the identity of their eggs. All the eggs I took were in the end of March; in April the nests contained young. The Public Works coolies employed on the roads had an abominable habit of digging out and eating the birds and eggs of this species, and many nests so destroyed came to my notice.

140.—THE GREAT HORNBILL.

Dichoceros cavatus, Shaw.

I found this much the scarcest of the four Hornbills found in Kanara, and certainly did not notice a dozen specimens in the eighteen months I was there. On the 12th February, 1890, I was shown a nest at Kutgul, just below the Devimane Ghât, and was told the birds had bred there for many years, though the villagers generally killed the old one, and the one young one (the villagers said there never was more than one), as soon as the latter was half-grown. The tree was a very high one, situated in a "kan" or wood of evergreen jungle. It was branchless for about 40 feet, where there was the stump of a small dead branch ; 4 or 5 feet further up a large branch had been torn away and left a sort of crevice, and in this the nest was placed. To get at it was no easy task ; a bamboo ladder some 10 feet long was, however, placed against the trunk, one of great circumference, and was tied to it by creepers every 3 or 4 feet ; a couple of men then climbed to nearly the top of this, and fastened a second ladder in the same way, and after some 4 hours work, they reached the small branch and stood on its stump, having tied a rope (creeper) round the tree to enable them to hold on. On a man putting his hand to the hole, a regular growl was heard, and the hen struck at his hand, nearly knocking him off the tree. A long knife was accordingly sent up, and, after a struggle, the poor bird was stabbed and pulled out. The nest contained one fresh egg (the only one that would have been laid). The cock called occasionally, but I never saw him ; the natives were very much afraid of him, and refused to attempt the nest, unless I stood below with a gun to shoot him if he attacked them.

145.—THE JUNGLE GREY HORNBILL.

Tockus griseus, Lath.

This is the commonest Hornbill in Kanara, and is generally distributed, though *Ocyceros birostris* almost entirely replaces it in the east of Sirsi. Its breeding habits are similar to those of *Birostris,* and I obtained a number of nests in February and the beginning of March. These contained each 2 or 3 eggs ; they vary in size, and are, I consider, undistinguishable from those of *Birostris.* The latter, however, frequently lays as many as 5 eggs, and they are, as a rule, a month later.

151.—THE BLUE-WINGED PAROQUET.

Paleornis columboides, Vigors.

This is the common parrot of the Ghâts, and the jungles immediately below them. I have been, however, very unlucky in finding its nests, and the only one I got containing eggs, was taken on

9th February, 1890, at Kutgal in the Kumta Taluka. It contained two hard-set eggs.

179.—THE MADRAS RUFOUS WOODPECKER.

Micropternus gularis, Jerd.

This is a common Woodpecker in Kanara, and though I have never taken their eggs, I have often found their nests. I think the birds continue to inhabit their old nests, as I have found them about a nest I had known for months, and there were no signs of any intention to lay again. The birds make a small tunnel into one of the nests of a small tree ant, and hollow out a largish chamber. I have always found the ants still there, and have been well stung on examining the nest-hole. I think this bird breeds as a rule in the rains, but in the middle of March a villager brought me 3 woodpecker eggs; I could not properly understand his dialect, and on his stating that the nest was an immense distance off [to enhance the value by proving he had taken a deal of trouble in finding it], as a protest against his taking the eggs himself instead of bringing me to them, I flung them on the ground. One of my sepoys afterwards told me, the same man had told him he had got them from an ant's nest half a mile off. This was no doubt the truth, but I was too disgusted to go to the place to see.

THE GREAT BLACK WOODPECKER.

Thriponax Hodsoni, Jerd.

This Woodpecker is not common, but one sees it occasionally in all the heavy jungles. I have never taken the eggs, but I saw a pair close to an enormous dead and rotten tree at Kutgal, in February. The tree contained several old nest holes, and one of the birds entered and left one of these. The tree was so rotten that no one could possibly climb it; I, however, visited it again in the early morning and again in the evening, and on both occasions fired a shot at it; as on neither occasion did I see anything of the birds, they cannot have been breeding there at that time, though no doubt it was an old nest, which like most other woodpeckers, they occasionally return to. At Sirsi, at the very end of February, two eggs, apparently Woodpecker's, were brought to me late one evening. The man said he had taken them from a hole in a tree, a mile or two away. They were much larger than eggs I possess of *Ch. Festivus,* and if Woodpecker's must have belonged to this species. Indeed if there had been only one, I might almost have accepted them without question—I have, however, never seen more than three of this large Woodpeckers together, and expect it generally at all events, only lays one egg. I was busy at the time, and returned them to the man who brought them, and who promised to replace them, and to bring me to the nest in the morning. He, however, never turned up, and though I had any amount of people searching for him, I never saw him again. I suspect he must have broken them in taking them back, and was afraid to show his face, having received a considerable reward.

181.—*Brachypternus puncticollis, Math.*

This woodpecker certainly does not take the place of *Aurantius,* in Kanara, as 9 out of every 10 golden-backed woodpeckers there are certainly *Aurantius.* At the same time I have procured two or three specimens with the dark throat, very distinct in appearance from *Aurantius.* I have unfortunately never obtained the pair when I shot a bird of the *Puncticollis* form; I have however shot pairs in which both male and female were *Aurantius.* I caught a female *Puncticollis* on her nest in the Sirsi Taluka in March, 1889. It contained two hard-set eggs undistinguishable from those of *Aurantius.*

198.—THE CRIMSON-THROATED BARBET.

Xantholæma Malabarica, Bly.

This is the most provoking bird I know. It is excessively common wherever there is thick jungle, and indeed in the "kans" among the cultivated land; its nest holes are everywhere, placed in dead branches in positions similar to those chosen by *Hæmacephala.* To get its eggs, however, I have found a very difficult matter. You devote a day in a place they abound to searching for their nests; you see or hear perhaps 30 couples; you start 6 birds out of their nest-holes; you have these carefully cut open. In 5 cases the holes are so easily placed, that even a fourteen-stone man like my unfortunate self could get at them without assistance; these, however, contain in one case small young, in another, young nearly fully fledged; while in the three other cases, the holes though completed, or almost completed, contain nothing. The sixth nest, on the other hand, is at the extreme end of a dead branch, high up. You take every care, have a rope tied round the branch, and having successfully cut it, proceed to lower it; it is however no use; just as you get a hold of the cut stump, the top breaks, and the eggs are scattered at your feet. This has happened to me more than once, and I possess but one egg, taken at Ekambe, in Sirsi, in March, 1890. It is impossible to judge from one specimen, but it seems smaller, and thicker-shelled than the majority of the eggs of *Hœmacephala.*

224.—THE LITTLE SPIDER HUNTER.

Arachnothera longirostra, Lath.

This is a shy bird, and one, I think, rare in Kanara. I have only seen it on a few occasions, and these all in gardens above the ghâts. I have taken, or had brought to me, 4 or 5 of its nests; and most wonderful structures they are. The bird chooses a large plantain leaf a few feet from the ground, and to its underside sews its nest. This is composed of skeleton leaves an inch or two thick, and nearly a foot, in some cases, in length. It has an entrance at each end, and in the middle there is a hollow thickly padded with fine grass. I have always found two eggs or young; the nests have always been found by me in February or March. The eggs resemble both in size and general appearance those of *Pratincola caprata,* but are slightly smaller, they are a pale pink, with a narrow, but very dark pink ring round the larger end; altogether a very striking egg, not mistakeable for any other I know.

233.—THE TINY HONEY-SUCKER.

Arachnechthra minima, Sykes.

This is the commonest Honey-sucker in Kanara, in the immediate neighbourhood of the ghâts, but is not found in the east of the district. It breeds from the middle of December to February. Its nest is a very beautiful one, built of green moss, adorned with the white webs of spiders and red ants. It is a neat little pocket, slightly smaller than that of either *Zeylonica* or *Asiatica.* I have found it occasionally suspended from bamboos or branches up to twenty feet from the ground, but two-thirds of the nests are on the

"Karwe" [*Strobilanthus*]. They are hung from the tips of the plants, generally from 4 to 6 feet from the ground, and generally on the outside of a clump. I have always found two eggs or young. The former have been all of one type, not in the least resembling those sent from the Neilgheries, and which are described as similar to *Asiatica* but miniatures. I have seen at least twenty clutches, and all were exactly alike, the ground-colour being pinky-white, and the larger end being well spotted with reddish-purple, a zone being formed in some cases; the eggs are also much smaller than those of *Asiatica*. If the Neilgheri eggs have been rightly identified, it seems strange that this bird should lay such different types of eggs.

235.—THE LARGE PURPLE HONEY-SUCKER.

Arachnechthra lotenia, Lin.

This bird is not uncommon in Kanara, and breeds both in the end of the rains and during the hot weather along the coast. Above the ghâts though I have often seen the bird I have never taken the nest. Mr. Aitken has already fully described the nest in this Journal, and the few I have seen agree with his description. The eggs are of the *Asiatica* type, and except being larger, cannot, I think be discriminated with certainty.

239.—THE NEILGHERY FLOWER-PECKER.

Dicaeum concolor, Jerd.

This flower-pecker is found in Kanara, at all events above the ghâts, but I have only one or two specimens, and I expect it is much rarer than *Erythrorhynchus*. Unless in the hand it is almost impossible to distinguish the one from the other, and one cannot keep shooting all the poor little birds one sees in order to find out exactly what they are. I shot one, however, from a nest in the Sirsi Taluka on the 28th March, 1890. The nest was about ten feet from the ground in a tree newly come into leaf, and was close to the main road, and I was able to take it without dismounting; the nest and eggs were undistinguishable from those of *Erythrorhynchus*.

264.—THE MALABAR WOOD-SHRIKE.

Tephrodornis Sylvicola, Jerd.

This shrike is a permanent resident in Kanara, and fairly common all over the district. It breeds in March and the early part of April.

The nests are in forks of leafless trees, frequently pollards, and are large masses of roots, bordered with green moss and ornamented with the webs of red ants. They exactly match the branch they are built on, and are exceedingly difficult to discover, building, as this bird does, where there are thousands of suitable trees. The bird, however, like its smaller ally *Pondicerianus* is a restless one, and constantly flies to and from its nest in pursuit of insects; consequently if a pair are noticed in the breeding season, it only requires an hour or so of careful watching to mark one or other bird on to the nest. I have never found more than two eggs or young in any nest, they are very broad ovals; the ground-colour is a greenish-white but a very clear white, and they are richly marked with brownish-purple at the larger end.

267.—THE LITTLE PIED SHRIKE.

Hemipus picatus, Sykes.

This bird is common in Kanara. I have, however, only found two nests; both were situated like the one I found previously in Nasik, on horizontal branches of the Silk-cotton tree, and both were only about twelve feet from the ground. Both nests were found in May.

282.—THE BRONZED DRONGO.

Chaptia aenea, Vieill.

This is very common bird in Kanara, and I obtained many of its nests. They were always neat little cups generally of light coloured roots and grass placed in forks of trees from ten to fifteen feet from the ground.

404.—THE SOUTHERN SCIMITAR BABBLER.

Pomatorhinus horsfieldi, Sykes.

This bird is common in Kanara. I however only obtained two nests. Both were large oval masses of grass, placed on the ground on a bank in thin jungle, but close to some heavy thickets. They were taken in February, 1890, and each contained three partially incubated eggs.

464.—THE MALABAR GREEN BULBUL.

Phyllornis Malabaricus, Gm.

This bird I consider rare in Kanara, and I have seen but few specimens. *Jerdoni* on the other hand is common everywhere. I obtained a nest on the 18th February at Sampkund in the Sirsi Taluka. It was a cup of very light-coloured grass or roots suspended between two branches on a tree in thin jungle. It was about 20 feet from the ground, and as it contained two very small young, I did not disturb it.

781 *bis.*—THE SOUTHERN INDIAN CARPOPHAGA.

Carpophaga cuprea, Jerd.

At page 329 of Vol. 5 of the Journal there is a note as to the nidification of *Carpophaga insignis.* This however is the result of a stupid clerical error on my part, and the note really refers to this species.

814.—THE RED SPUR FOWL.

Galloperdix spadiceus, Gm.

This bird was very common in Kanara, as also in several other districts in which I have served. I have found its nests at all times during the hot weather; *i. e.,* from February to June.

I notice Mr. Barnes following nearly every other writer; states it lays from five to eight eggs, seldom more. Now in the various districts I have found this bird breeding, I must have seen 30 or 40 nests and I cannot recollect ever finding more than three eggs. I have now before me the records of fifteen clutches, nine from Kanara and six from Nasik. All contained three eggs, and in most of the cases the eggs were well incubated. I therefore think it is probable that the large clutches mentioned by others must at all events in some cases have been the produce of more than one hen.

936 *bis.*—THE MALAYAN TIGER BITTERN.

Goisakius melanolophus, Raffl.

The bird, I believe, is not only very shy, but also very rare in Kanara, and I only twice came across adult birds. These were in each case single specimens. One was at Siddapur above the ghâts, and was in May; the other was at Karwar in the middle of the rains. The bird must however breed in Kanara, as a young one, unable to fly, was brought to me alive in the beginning of October. The man who brought it said he caught it in a rice field adjoining thick jungle. I was unable to find time to go with him and see if any further specimens were about the place.

ON NEW AND LITTLE-KNOWN BUTTERFLIES FROM THE INDO-MALAYAN REGION.

BY LIONEL DE NICÉVILLE, F.E.S., C.M.Z.S., &c.

(With Plates F and G.)

Family NYMPHALIDÆ.

Subfamily SATYRINÆ.

Genus MYCALESIS, Hübner; subgenus MYRTILUS, nov.

MALE. FOREWING, *costa* strongly and regularly arched; *apex* rounded; *outer margin* nearly straight; *inner angle* acute; *inner margin* at first slightly emarginate, then just beyond the middle strongly bowed outwards; *costal nervure* swollen at base, ending on the costa beyond the apex of the discoidal cell; *first subcostal nervule* emitted at about one-fifth before the end of the cell, terminating on the costa about opposite to the origin of the third subcostal; *second* subcostal originating a little before the end of the cell, ending on the costa a little before the origin of the fourth subcostal; *third* subcostal arising exactly midway between the apex of the cell and the origin of the fourth subcostal, terminating on the costa about midway between the origin of the fourth subcostal and the apex of the wing; *fourth* subcostal short, ending at the apex of the wing; terminal portion of *subcostal nervure* longer than the fourth subcostal nervule, ending on the outer margin below the apex of the wing; *upper disco-cellular* nervule extremely short; *middle* disco-cellular about one-fourth as long as the lower disco-cellular, straight, strongly inwardly oblique; *lower* disco-cellular at first strongly inwardly oblique, in a straight line with the middle disco-cellular (this portion being a little longer than that vein), then suddenly curved and strongly outwardly oblique, straight posterior to the curve; *median nervure* strongly swollen at base; *third median nervule* strongly curved; *second* median arising long before the lower end of the cell; *discoidal cell* reaching exactly to the middle of the wing; *submedian nervure* swollen at base, beyond this swollen portion distorted and deflected downwards, afterwards straight to the outer margin; a large patch of *androconia* occupying the lobe-like dilatation of the inner margin, and extending as far as the middle of the submedian interspace, placed on the underside of the wing. HINDWING, *costa* arched at base, then almost straight to apex; *outer margin* slightly curved, gently scalloped; *abdominal* margin almost straight; *precostal nervure* short, simple, directed towards the apex of the wing; *costal* nervure short, not reaching to the middle of the costal margin, regularly curved throughout its length; *first subcostal nervule* curved, arising just before the apex of the cell, and terminating at the apex of the wing; *second* subcostal nearly straight, ending on the outer margin below the apex; *discoidal cell* short, its lower end not reaching to the middle of the wing; *disco-cellular nervules* almost straight, strongly outwardly oblique, the lower a little longer than the upper; *third median* nervule strongly curved; *second* median originating immediately before the lower end of the cell; *submedian nervure* straight, distinctly swollen towards the base for some considerable portion of its length, ending just anterior to the anal angle; *internal* nervure short, recurved; a large patch of *androconia* about the apex of the cell, occupying a considerable area in the subcostal interspace, the base of the first and second subcostal interspaces, and extending into the apex of the cell; a strong *tuft of hairs* of a brown colour arises from near the base of the cell and is directed outwardly, lying across the anterior portion of the androconial patch; there is also a second strong tuft of hairs of a black colour arising close to the base of the submedian nervure and lying along the swollen portion of that vein. *Eyes* hairy. *Antennæ* a little less than half the length of the costa of the forewing, with a rather large, well-formed club. Type, *Mycalesis* (*Myrtilus*) *mystes*, de Nicéville.

This subgenus falls into Mr. Moore's third group of the subgenera of *Mycalesis*,* which possesses two tufts of hairs on the hindwing in addition to a glandular patch of scales differently formed to those on the rest of the wing (androconia), and another patch on the forewing. This group has hitherto contained one subgenus only, *Loesa*, Moore, which shares (as far as Mr. Moore's diagnoses tell us, in numerous cases the veinlet in question is not mentioned at all, as Mr. Moore never seems to describe his genera on any recognised or constant plan) with *Lohora*, Moore,—a subgenus of the second group which possesses one tuft of hairs only on the hindwing,—the peculiar character of the second subcostal nervule of the forewing being emitted beyond the apex of the discoidal cell. In *Myrtilus* it is emitted well before, which appears to be the best character by which it can be distinguished from the subgenus *Loesa*, but possessing no specimen of my own of the latter I am unable to bleach the wings and examine the neuration critically so as to give a full detailed comparative description.

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* Trans. Ent. Soc. Lond., 1880, p. 177.

1. MYCALESIS (*Myrtilus*) MYSTES, n. sp.

HABITAT: Upper Burma.

EXPANSE: ♂, 2·0 inches.

Dry-Season Form, Pl. F, Fig. 1, ♂.

DESCRIPTION: MALE. UPPERSIDE, *both wings* brown, the extreme outer margins paler, bearing two very fine darker brown lines. *Cilia* cinereous. *Forewing* with three very small (the posterior rather the largest) blind black ocelli, one each in the two discoidal and upper median interspaces, each surrounded with a fine outer yellow line (the two posterior ocelli absent in one specimen); a similar large ocellus in the same straight line as the other ocelli, and touching the lowermost, in the first median interspace, which it slightly overlaps, centred with a minute silvery pupil. *Hindwing* unmarked. UNDERSIDE, *both wings* ochreous-yellow, the basal darker than the outer half; a prominent perfectly straight discal band, not quite reaching the costa of the forewing nor the abdominal margin of the hindwing, this band is formed of an inner dark brown line, which becomes lost in the ground-colour, outwardly sharply defined by a whitish line, which also soon becomes lost in the ground-colour; beyond this prominent discal band is a nebulous band of a darker shade than the ground, and bearing in the forewing four (in one specimen five), and in the hindwing seven, most minute pale blue dots, one in each interspace, these being the pupils of obsolete ocelli; a waved submarginal band.

Described from two male specimens captured by Lieutenant E. Y. Watson at Tilin Yaw, Upper Burma, on the 1st and 19th March, 1890.

Wet-Season Form. Pl. F, Fig. 2, ♂.

DESCRIPTION: MALE. UPPERSIDE, *both wings* brown, the extreme outer margins paler, bearing two wavy fine darker brown lines. *Cilia* cinereous. *Forewing* with a single round black ocellus in the first median interspace, beyond which it does not extend, pupilled with white, with a narrow outer pale ring. *Hindwing* unmarked. UNDERSIDE, *both wings* brown, the outer margin bearing two yellowish waved lines, the disc crossed by a narrow prefectly straight pure white band which does not quite reach the costa of the forewing nor the abdominal margin of the hindwing. *Forewing* with four ocelli enclosed in a single outer yellowish line, the two upper ocelli small, equal-sized, the third the smallest, the fourth and lowest the largest. *Hindwing* with seven ocelli, also enclosed by one line, of which the first (uppermost), the fourth, and the fifth are the largest, the third and the seventh equal-sized and the smallest.

Described from a single example captured by Lieutenant E. Y. Watson at Yedu Yaw, Upper Burma, on 23rd November, 1889.

The dry-season form of *M. mystes* is easily recognisable by the curious ochreous-yellow colour of the ground on the underside, but the wet-season form is so precisely similar to many specimens of the same seasonal form of *M.* (*Calysisme*) *mineus*, Linnæus, that it might be easily confounded with that species. The male, however, has the conspicuous tuft of black hair on the upperside of the hindwing, springing from near the base of the submedian nervure, which is characteristic of this subgenus, and is not found in *Calysisme*, and by which it can be easily recognised. In the subgenus *Loesa*, this tuft is yellow not black, and springs from the middle instead of near the base of the submedian nervure. The females of the wet-season form of *M. mystes* will, probably, be difficult to discriminate, as in neuration and markings they will, probably, be found to be almost exactly like *M. mineus*.

Subfamily MORPHINÆ.

2. CLEROME KIRATA, n. sp., Pl. F, Fig. 3, ♂.

C. kirata, Doherty, MS.

HABITAT: Padang Rangas, Perak (*Doherty*); Borneo.

EXPANSE: ♂, 2·5 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich fulvous, darkening towards the outer margins. *Hindwing* rather brighter and richer coloured than the forewing. UNDERSIDE, *both wings* ochreous-brown, with a distinct glossy sheen in some lights. *Forewing* with a short deep brown streak towards the base of the discoidal cell; a broad band across its middle, extending posteriorly into the submedian interspace; a still broader irregularly-edged discal band, commencing near the costa, ending on the first median nervule; a very obscure marginal line; a regularly scalloped submarginal line; within which and nearer to it than to the discal band is a series of six round ochreous dots placed one each on the internervular folds, the anterior dot of all out of line, shifted inwardly. *Hindwing*, with the anal half of the wing deep brown, in which the deep brown markings of the anterior half of the wing become entirely merged; a deep brown spot towards the base of the discoidal cell; a subbasal band crossing the middle of the cell; a discal band; a submarginal line—all much as in the forewing; a series of seven dots as in the forewing, but curving regularly across the disc, one in each interspace, except the submedian, which has two.

C. kirata may be known from specimens of *C. arcesilaus*, Fabricius, from all the localities from which I have received the latter (many parts of Assam and the Malay Peninsula, Java, and Borneo) by the much greater breadth of the deep brown bands of the underside, these becoming quite lost in the dark anal half of the hindwing; in *C. arcesilaus* the hindwing is concolorous throughout, and the bands (which are so narrow as to be lines rather than bands) are plainly visible throughout their course.

Mr. Doherty has kindly sent me his unpublished MS. description of this species, from which the following is extracted:—"The prehensores present strong differences. Seen from the side the uncus of *C. kirata* beyond the usual globose base runs obliquely downwards for some distance, and ends in a short vertical drop with a single acute point, the branches are regularly curved forward from their bases. In *C. arcesilaus* the uncus is sinuous, and ends in a long incurved hook; the branches are also sinuous and distinctly angled about half-way from the base, slender and straight beyond the angle. In *C. gracilis*, Butler, from the Malay Peninsula and North Borneo, the uncus is much as in *C. kirata,* but thicker and shorter, with the branches clavate at tip. The clasp of *C. arcesilaus* seen from the side, is beyond its swollen base narrow and gradually tapering, the upper contour slightly concave throughout and unarmed, the point gradually acuminate. In *C. kirata* the clasp beyond the swollen base is constricted to a long narrow neck, thereafter expanding to a broad blade, the upper contour obviously convex and roughened by numerous raised lines, the point rather blunt and abrupt. Described from a single male taken near Padang Rangas, Perak, in deep forest. The prehensores of Chittagong and Malayan specimens of *C. arcesilaus* are exactly alike."

Described from two males from South-Eastern Borneo in my collection.

Subfamily NYMPHALINÆ.

3. ARGYNNIS MACKINNONII, n. sp., Pl. F, Figs. 4, ♂; 5, ♀.

HABITAT: Basahir, N.-W. Himalayas.

EXPANSE: ♂, 1·50 to 1·60; ♀, 1·55 to 1·65 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* bright fulvous, the base more or less heavily irrorated with black. *Forewing* with the usual double zig-zag black lines across the middle of the discoidal cell, a black streak closing the cell, and exactly midway between these streaks is another narrowest one extending across the cell; the disc bears three series of black spots—the first is placed irregularly just beyond the cell, and consists of six irregularly-shaped spots, the second consists of a regularly sinuous series of seven round spots, the third of eight cordiform spots following the outline of the outer margin; this latter is narrowly black; a small triangular black patch on the costa placed just within the middle series of black spots. *Hindwing* with a pair of elongated streaks joined at both ends at the end of the cell, a curved series of spots immediately beyond the cell, then another series of five or six rounded spots, followed by a series of seven lunulated spots, between these latter and the black outer margin is a series of pale fulvous spots which are much more distinct in some specimens than in others. UNDERSIDE, *forewing* bright fulvous; all the black spots of the upperside present but much smaller; an oblique apical rich castaneous streak, inwardly marked with two, outwardly by four silvery spots. *Hindwing* with the ground-colour much more yellow than in the forewing, the base bearing large blotches of rich castaneous, with prominent discal and marginal bands of the same colour; with the following silvery spots:—a small one placed on the precostal nervure, one filling the base of the costal interspace, and a large one placed obliquely across its middle; a small round spot in the middle of the cell, a large elongated one filling its outer end, joined to another elongated spot in the discoidal interspace reaching to the outer edge of the discal rich castaneous band, this latter bears on its outer edge a series of seven more or less wedge-shaped spots, the uppermost of which in the costal interspace is much the largest; an elongated narrow silvery streak in the submedian interspace, which springs from the base of the wing and ends on the inner edge of the rich castaneous discal band, the streak is quite separated or broken into two portions at about its middle; there is a second narrow streak in the internal interspace, which commences opposite the point where the streak in the submedian interspace is broken and reaches the abdominal margin; a very indistinct somewhat ocellular series of spots placed in the middle of the band of the ground-colour between the discal and marginal rich castaneous bands; the latter bearing a prominent series of more or less oval silvery spots, one in each interspace. *Cilia* of both wings on the upperside pale fulvous, of the forewing on the underside on the apical half of the wing pale fulvous alternated with darker, on the hindwing pale fulvous throughout. Female. Upperside, *both wings* darker fulvous than in the male, all the black spots larger, the black basal irroration much more extensive, completely filling the sutural area of the forewing, the outer margin broadly black, bearing a series of very pale yellow (almost whitish) spots. Underside, *forewing* as in the male, but all the markings more prominent. *Hindwing* with the ground-colour more of a greenish tinge, the rich castaneous bands and the silvery spots more prominent. *Cilia* very pale yellowish, almost white, on the forewing prominently, on the hindwing obscurely alternated with darker.

Very close to the *Argynnis altissima* of Elwes,* ten specimens of which were obtained on one occasion only, and never since, by Mr. H. J. Elwes' native collectors somewhere on the high passes of native Sikkim ten years ago. Mr. Elwes has figured the species, but I am not able to judge from the figure whether the specimen delineated is a male or a female. He describes the male sex only, but the two specimens I possess, kindly given to me by Mr. Elwes, are certainly females. *A. mackinnonii* differs from the same sex of *A. altissima* on the upperside in its deeper and richer fulvous ground-colour, the marginal series of very pale yellow spots more rounded and usually smaller, the darker ground-colour of the underside, the presence especially of the rich castaneous markings of the hindwing, which, as Mr. Elwes says in his description, and is borne out by my specimens, "are almost absent" in *A. altissima*; the silvery streak in the submedian interspace of the latter species is also unbroken; the series of spots placed in the middle of the band of the ground-colour between the discal and marginal rich castaneous bands is far less distinct in *A. mackinnonii*; lastly, the silvery marginal spots are considerably shorter and broader in the latter species.

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* Proc. Zool. Soc. Lond., 1882, p. 403, pl. xxv, fig. 8, ? *male*. In Trans. Ent. Soc. Lond., 1889, p. 539, Mr. Elwes refers to this figure as taken from a male.

Mr. P. W. Mackinnon (after whom I have much pleasure in naming it) obtained through his native collectors seventeen specimens of this species last August below the Gonas Pass on the north face of the hill, about half-way between the Pass and the Baspa Valley, at nearly 11,000 feet elevation, Basahir. The Nila Pass is at the summit of the Nila and Baspa Valleys; through the former runs the Nila River, S.-E. into the Ganges, while the Baspa River runs through the latter W. into the Sutlej. The Nila Pass is the boundary between Tehri Gurwhal and Basahir. The Gonas Pass is one of three or more passes from the valleys to the south which lead into the Baspa Valley. None of these passes are much used by Europeans, so there is not much information available regarding them.

I may here note that if the genus *Brenthis*, Hübner, is mainly if not wholly based on the fact that the second subcostal nervule of the forewing is emitted from the costal nervure beyond the apex of the discoidal cell, and is maintained as distinct from the genus

Argynnis, Fabricius, by Mr. Samuel H. Scudder and others, it is apparently a character not at all to be relied on even in the same species. In my two female specimens of *Argynnis altissima*, Elwes, one has this nervule emitted some considerable distance beyond, the other exactly at the apex of the cell; while in the ten specimens of *A. mackinnonii* that I have examined, nine have the veinlet given off well beyond, while one has it at the end of the cell. In typical *Argynnis* the nervule in question is given off before the end of the cell. We have, therefore, in the genus *Argynnis* the second subcostal nervule emitted before, at, and beyond the end of the cell, and in two Indian species at any rate the position of this veinlet is inconstant.

4. NEPTIS NAR, n. sp., Pl. F, Fig. 6, ♀.

HABITAT: South Andaman Isles.

EXPANSE: ♀, 2·7 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* black. *Cilia* black, a small portion white on each internervular fold. *Forewing* with a lengthened increasing ochreous band occupying the posterior half of the discoidal cell, hardly separated from a triangular ochreous-white spot beyond; three outwardly-obliquely-placed conjoined subapical ochreous-white spots, their edges tinged with darker ochreous, the uppermost spot linear, very small; a sinuous submarginal, a more straight marginal obscure sullied line; four inwardly-obliquely-placed discal ochreous-white spots, arranged two and two, from near the middle of the inner margin to the second median interspace; the uppermost spot a small clump of ochreous scales only, the next rounded, the two posterior divided only by the submedian nervure. *Hindwing* with a broad anteriorly-decreasing almost pure white discal band, just faintly tinged with ochreous only, commencing from the abdominal margin, but not reaching the costa; an obscure much narrower submarginal sullied band. UNDERSIDE, *both wings* blackish-brown, all the white markings of the upperside suffused with pale violet. *Forewing* with the discoidal streak joined to the triangular spot beyond, but anteriorly notched at the end of the cell; the discal spots larger and whiter; the two lines on the margin broader, purplish-white, prominent. *Hindwing* with a short basal pure white band on the costa, between which and the broad pure white discal band of the upperside is a short basal pale violet band; just beyond the broad discal band is a narrow pale violet band, beyond this again is a broad pale violet band, then a narrow straight submarginal line.

N. nar has no near ally, as far as I am aware; it is an abundantly distinct as well as beautiful species. It obviously comes into the group containing *N. sankara*, Kollar,* *N. amba*, Moore, *N. amboides*, Moore, and *N. carticoides*, Moore, as it has the short basal band on the underside of the hindwing between the costal and discal bands, which is a marked feature of all these species, and with which also it agrees more or less in size and outline; but the ochreous-sullied markings of the upperside, and the very purple coloration of the underside, will distinguish *N. nar* at a glance from all its allies.

Described from two examples lately sent to me by Mr. R. Wimberley. It must be very rare, as during the past twelve years I have examined many thousands of butterflies from Port Blair, and these are the first and only specimens I have seen.

5. EUTHALIA APPIADES, Ménétriés.

In the Proceedings of the Entomological Society of London for 1890, pp. xi and xii, Colonel Charles Swinhoe gives "Notes on certain species of the genus *Euthalia*." In this paper he strives to maintain that *E. sedeva*, Moore, is a good species, and that *E. balarama*, Moore, is its opposite (male) sex, though in the Proceedings of the Zoological Society of London for 1865, p. 766, Mr. Moore himself placed his *sedeva* as a synonym of *E. appiades*, Ménétriés. Quite recently, while at Oxford, I had an opportunity of seeing the specimens from "Buxar," Bhutan, on which Colonel Swinhoe based his remarks, and a pair of which he kindly gave me. Regarded superficially, these "Buxar" specimens might (specimens from other localities being left out of consideration), by straining a point, in fact, be admitted to be a species distinct from the immensely common *Euthalia appiades*, Ménétriés, of Nipal, Sikkim, Bhutan, Assam, &c. The points on which Messrs. Swinhoe and Moore rely in distinguishing these two species are that in the forewing, on both sides, in both sexes the double discal band is contracted and approximates in the lower discoidal interspace, and that in the female it anteriorly expands beyond that point, forming large white spots on both sides of the wings.

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* I recently had the opportunity of examining what is probably the type specimen of *Limenitis sankara*, Kollar, in the Natural History Museum at Vienna, where apparently all the type specimens described by Kollar in Hügel's Reise Kaschmir are to be found. The specimen is a female, and is the species from the Western Himalayas described as *N. amba*, Moore, in "The Butterflies of India, Burmah and Ceylon," vol. ii, p. 88, n. 368 (1886). Whether the true *N. amba*, Moore, described from Nepal, and subsequently identified from Yunan by Mr. Moore, is a species distinct from *N. sankara*, must remain a question for future solution. Till now *Neptis sankara* has been unidentified, as it was placed by Mr. Westwood in "The Genera of Diurnal Lepidoptera," vol. ii, p. 274, n. 6, and by subsequent authors, in the genus *Athyma*.

To take the males first. *E. sedeva* is not a local race confined to one particular locality, as Colonel Swinhoe admits that it occurs with *E. appiades* at Buxar, and I possess exactly similar specimens from Sikkim on the west and from Cachar in Assam on the east. The contraction of the discal band is also characteristic of *E. xiphiones*, Butler, which occurs to the south of Assam in Burma and in the Malay peninsula. *E. xiphiones* may, however, be known in the male by its broader blue border to the hindwing on the upperside.

Then as to the females. Their characteristic feature is a white discal macular band to the forewing much expanded anteriorly. I have not ypical specimens of this form from Sikkim, where the females of *E. appiades* appear to be very constant; but directly one goes east of Sikkim into the next State, Bhutan, one finds all forms ranging from typical *E. appiades* to typical *E. sedeva*, as is also the case in Assam and Burma. I maintain, therefore, that although extreme specimens of *E. appiades* may be picked out and are typical *E. sedeva*, that intermediates between the two forms occur, and that *E. sedeva* cannot be maintained as a distinct species or even as a local race, as it inhabits no restricted area as has been shewn above.

In the Annals and Magazine of Natural History, sixth series, vol. v, p. 354, n. 2 (1890), Colonel Swinhoe describes *E. khasiana* from the Khasia Hills. He compares it with *E. appiades*, Ménétriés, but says the blue coloration of the upperside of the hindwing in the male is either confined to a "few greyish-blue scales on the outer margin towards the anal angle," or is "obsolete" altogether, the latter form being typical *E. adima*, Moore. In the Journal of the Asiatic Society of Bengal, vol. lvii, part 2, p. 278, n. 6 (1888), I have at some length pointed out how very variable *E. adima* is. Mr. Doherty [l. c., vol. lviii, part 2, p. 127 (1889)] has also done the same, but at less length. Colonel Swinhoe has apparently not seen these two papers, or he would, I think, hardly have described his *E. khasiana*, which species is an absolute synonym of *E. adima*, and is, in my opinion, nothing but a local race of *E. appiades* confined to the Khasi Hills and Upper Assam. Since I wrote my note on *E. adima* quoted above, I have obtained additional specimens still more closely linking it to *E. appiades*, so that I think the time has now arrived when the two species may be safely united.

Lastly, *E. xiphiones*, Butler, belongs to this group. It is a common species throughout Burma, and has been recorded from Perak in the Malay peninsula by Mr. Distant. The male differs chiefly from *E. appiades* in having the blue border on the upperside of the hindwing a little broader; the female is very variable, having the discal band of the forewing sometimes white, as in typical *E. sedeva*, sometimes as in typical *E. appiades*, with every gradation between them, one of which is *E. parvata*, Moore. I think the synonymy of this group should be thus arranged:—

6. EUTHALIA APPIADES, Ménétriés.

Adolias appiades, Ménétriés, Cat. Mus. Petr., Lep., vol. ii, p. 120, n. 1263, pl. ix, fig. 4, *male* (1857); *Adolias sedeva*, Moore, Trans. Ent. Soc. Lond., new series, vol. v, p. 68, n. 10, pl. iv, fig. 3, *female* (1859); id., Swinhoe, Proc., Ent. Soc. Lond., 1890, p. xi; *Adolias balarama*, Moore, Proc. Zool. Soc. Lond., 1865, p. 766, pl. xli, fig. 3, *male*.

HABITAT: Nipal, Sikkim, Bhutan, Assam.

Local race *adima*, Moore.

Adolias adima, Moore, Horsfield and Moore, Cat. Lep. Mus. E. I. C., vol. i, p. 194, n. 392 (1857); idem, id., Trans. Ent. Soc. Lond., new series, vol. v, p. 76, n. 29 (1859); *Euthalia adima*, de Nicéville, Journ. A. S. B., vol. lvii, pt. 2, p. 278, n. 6 (1888); *Tanaëcia adima*, Doherty, l. c., vol. lviii, p. 127 (1889); *Euthalia khasiana*, Swinhoe, Ann. and Mag. of Nat. Hist., sixth series, vol. v, p. 354, n. 2 (1890).

HABITAT: Khasi Hills; Margherita, Upper Assam.

Local race *xiphiones*, Butler.

Adolias xiphiones, Butler, Proc. Zool. Soc. Lond., 1868, p. 609, n. 60, pl. xlv, fig. 6, *male*; *Euthalia xiphiones*, Distant, Rhop. Malay., p. 439, n. 22, pl. xxxvi, figs. 10, *male*; 9, *female* (1886); *Adolias parvata*, Moore, Proc. Zool. Soc. Lond., 1878, p. 831, pl. lii, fig. 3, *female*.

HABITAT: Burma, Malay peninsula.

7. EUTHALIA ERIPHYLÆ, n. sp., Pl. F, Fig. 7, ♂.

HABITAT: Tenasserim.

EXPANSE: ♂, 2·5 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* shining greenish-brown. *Forewing* with a short fuscous bar near the base of the discoidal cell; a quadrate patch of the ground-colour enclosed by a fine fuscous line across the middle of the cell; then a quadrate patch of fuscous; lastly, an oval patch of the ground-colour closing the cell; in the submedian interspace is a short curved fuscous line close to the base, and a ringlet spot at the point where the first median nervule is given off; a very broad discal fuscous band, which anteriorly bifurcates in the lower discoidal interspace and encloses a triangular patch of the ground-colour, and posteriorly encloses two spots also of the ground-colour, the anterior spot in the first median interspace linear, the posterior spot in the submedian interspace round. *Hindwing* with the basal two-thirds fuscous, beyond which is an obscure series of diffused fuscous spots between the veins, neither reaching the costa nor the anal angle; a fuscous ring-spot at the end of the cell enclosing a space of the ground-colour. UNDERSIDE, *both wings* paler than on the upperside. *Forewing*, discoidal cell crossed by the four usual curved fuscous lines; a submarginal curved fuscous band, anteriorly attenuated and ending in an irrorated patch of bluish-white scales at the extreme apex of the wing, posteriorly in a rather large rounded spot on the submedian fold. *Hindwing* with the usual fuscous linear lines in and around the discoidal cell; no other markings whatever.

Nearest to *E. garuda*, Moore, and at first sight giving the impression that it is only a suffused aberration of that species. As, however, Mr. H. J. Elwes, to whom I am indebted for the specimen described, possesses several other specimens exactly similar from the same locality, I think it probable that the species is a good one. From *E. garuda* it differs on the upperside of the forewing in having the two well-separated dark bands across the disc in that species run together in the middle; on the hindwing the basal area is much darker, and the prominent submarginal series of blackish spots of *E. garuda* is obsolescent. On the underside the submarginal band of the forewing ends at the apex, while in

E. garuda it reaches the costa far internal to that point; lastly, in the hindwing there is no submarginal series of black points whatever.

Described from a single male from Tenasserim obtained by Major C. T. Bingham. Mr. H. J. Elwes possesses several additional specimens obtained by the same gentleman in the same locality. I am indebted to Mr. Elwes for the gift of the specimen described above.

8. SYMBRENTHIA HIPPOCLUS, Cramer, Pl. F, Fig. 10, ♀.

Papilio hippoclus, Cramer, Pap. Ex., vol. iii, p. 46, pl. ccxx, figs. C, D, *male* (1779) ; *Symbrenthia hippoclus*, de Nicéville, Journ. A. S. B., vol. li, pt. 2, p. 57 (1882) ; id., Doherty, Journ. A. S. B., vol. lv, pt. 2, p. 122, n. 72 (1886) ; idem, id., l. c., vol. lx, pt. 2, p. 172 (1891); id., de Nicéville, Butt. of India, vol. ii, p. 240, n. 53 (1886); id., Wood-Mason and de Nicéville, Journ. A. S. B., vol. lv, pt. 2, p. 362, n. 94 (1886) ; id., Elwes and de Nicéville, l. c., p. 421, n. 46 ; id., Holland, Proc. Bost. Soc. Nat. Hist., vol. xxv, p. 63, n. 39 (1890) ; *Hypanartia hippocla*, Hübner, Samml. Ex. Schmett. (1816-1824) ; *Laogona hippocla*, Moore, Proc. Zool. Soc. Lond., 1865, p. 762 ; id., Wallace, Trans. Ent. Soc. Lond., 1869, p. 344, n. 1; *Vanessa hyppocla*, Godart, Enc. Méth., vol. ix, p. 298, n. 5 (1819) ; Suppl., p. 818 (1823); *Laogona hyppocla*, Doubleday, Gen. Diurn. Lep., vol. i, p. 191, n. 1 (1848) ; id., Horsfield and Moore, Cat. Lep. Mus. E. I. C., p. 153, n. 315 (1857) ; *Symbrenthia hyppocla*, Moore, Proc. Zool. Soc., Lond., 1874, p. 268, n. 27 ; *Symbrenthia hyppoclus*, de Nicéville, Journ. A. S. B., vol. l, pt. 2, p. 50, n. 18 (1881); id., Moore, Proc. Zool. Soc. Lond., 1882, p. 243, pl. xi, figs. 4, *larva ; 4a, pupæ;* id., Standinger, Ex. Schmett., pt. 1, p. 96, pl. xxxvi, *male* (1885); id., Kheil, Rhop. der Insel Nias, p. 21, n. 39 (1884); id., Distant, Rhop. Malay., p. 431, n. 1, pl. xlii, figs. 4, *male ;* 5, *female* (1886); *Papilio lucina*, Cramer, Pap. Ex., vol. iv, p. 82, pl. cccxxx, figs. E, F, *female* (1780) ; *Symbrenthia lucina*, Semper, Schmett. der Philipp. Ins., pt. 1, p. 114, n. 134, pl. xxi, figs. 7, *male ;* 8, *female* (1888) ; *Symbrenthia daruka*, Moore, Proc. Zool. Soc. Lond., 1874, p. 570, pl. lxvi, fig. 10, *male ; Symbrenthia anna*, Semper, Schmett. der Philipp. Ins., pt. 1, p. 114, n. 135, pl. xxi, figs. 5, *male ;* 6, *female* (1888); *Symbrenthia hypatia*, Wallace (?), var. *dissoluta*, Standinger, Iris, vol. ii, p. 49 (1889).

HABITAT : Amboyna, China (*Cramer*) ; Sikkim, Himalayas, Assam, Burma (*de Nicéville*) ; Kumaon, Eastern Ghâts, Sambawa, Eastern Java (*Doherty*) ; Cachar (*Wood-Mason* and *de Nicéville*) ; Tavoy (*Elwes* and *de Nicéville*) ; Celebes (*Holland*) ; Bengal, Kashmir, N. India, Kangra District (*Moore*) ; Java, Celebes, Moluccas, India (*Wallace*) ; Java, Amboyna, China (*Godart*) ; N. India, Java (*Doubleday*) ; Java, Darjiling, Bhutan, N. India (*Horsfield* and *Moore*) ; Nias Island (*Khiel*) ; India, Borneo, Sumatra, Java, Amboyna, Celebes, Batjan, Luzon, Palawan (*Staudinger*); Malay peninsula, Borneo (*Distant*); Philippine Isles, Batjan, Ceram (*Semper*); Perak, Malay peninsula (*coll. Perak Museum*).

Herr Semper, in his work on the Butterflies of the Philippine Isles, does not apply the name *hippoclus* to the species of this genus occurring in the regions of which he treats, but uses instead the second oldest name, *lucina*, also of Cramer. His reason for this appears to be that Cramer figured *S. hippoclus* with an outer discal series of white instead of violet spots on the underside of the hindwing. No author from Godart to the present day has, however, ventured to keep *hippoclus* and *lucina* distinct on account of what is probably a slight inaccuracy of colouring only, nor has Herr Semper been able, as far as I am aware, to produce a specimen agreeing with Cramer's figure of *hippoclus*. Till this is done, I think it desirable that this species should be known by the older and long-accepted name. Dr. O. Staudinger, in his "Ex. Schmett.," says that only one species occurs in Amboyna, which must, therefore, be the true *S. hippoclus*. As regards Herr Semper's new species, *S. anna*, he has sent me male specimens of it from the Philippines which do not differ at all, as far as I can see, from male specimens of *S. lucina* he has also sent me from the same region. To judge from his figures of *S. anna*, the female appears to have the markings of the upperside white tinged with yellow. It is probable, therefore, that *S. hippoclus* is dimorphic in the Philippines in the female sex, and that the albino form equals *S. anna*.

M. Godart describes the female of *S. hippoclus* as differing from the male in that the bands of the upperside of the wings are white instead of yellow; on the underside they are paler, and the abdomen is whitish ringed with brown. One of the localities he gives for this species is Java.

In the "Genera of Diurnal Lepidoptera," vol. i, p. 191, it is stated that the female of "*Laogona hyppocla* has the fulvous colour of the upper surface replaced by white."

Mr. A. R. Wallace says that the Indian form of *S. hippoclus*, with a white female, is probably distinct from the form which occurs in Java, Celebes, and the Moluccas, and has not yet been named; that the type of *S. hippoclus* is given by Cramer as from

Amboyna; and that the form from Celebes differs considerably in markings, and may be distinct.

Mr. W. Doherty states that in Eastern Java he found that the female of *S. hippoclus* is dimorphic, one form having the yellow spots replaced by white ones, so that it resembles a white *Neptis* instead of a yellow one. No intermediate forms were seen.

Dr. O. Staudinger in "Iris," vol. ii, p. 49 (1889), mentions incidentally the occurrence in Java of a white female form of *S. hippoclus*, in describing his *S. hypatia*, Wallace (?), var. *dissoluta*, from Palawan, which is said also to have a white female. Dr. Staudinger is evidently quite unacquainted with the true *S. hypatia*, which is, perhaps, the most distinct species in the genus; and should have made his *dissoluta* a local form of *S. hippoclus* rather than of *S. hypatia*.

These are all the references I can find to the white female form of *S. hippoclus*, which I take this opportunity to figure from one of two Eastern Javan specimens very kindly given to me by Mr. Doherty. I think Mr. Wallace must have meant Java when he said that the form in India has a white female. I cannot agree with him that the Indian and Javan forms are distinct and should bear separate names. The males of the two are quite indistinguishable, and the white form of the female (which is the only one I have seen from Java) differs from the ordinary form only in having all the yellow markings replaced by white. Dimorphism in the family *Nymphalidæ* is extremely rare, and I am glad to prominently direct attention to Mr. Doherty's discovery of the phenomenon in this genus.

9. SYMBRENTHIA HYPSELIS, Godart, Pl. F, Fig. 8, ♂.

Vanessa hypselis, Godart, Enc. Méth., vol. ix, Suppl., p. 818, n. 5—6 (1823); *Laogona hypselis*, Boisduval, Sp. Gén., vol. i, pl. x, fig. 3, *male* (1836); *Symbrenthia hypselis*, de Nicéville (part), Butt. of India, vol. ii, p. 241, n. 535 (1886).

Habitat: Java (*Godart*, and *coll. de Nicéville*).

Expanse: ♂, 2·0 to 2·2 inches.

Description: Male. Upperside, *both wings* black, with rich dark fulvous markings. *Forewing* with a discoidal streak, its upper edge irregular, its lower edge very irregular and extending well below the discoidal cell; a short subapical streak divided into two portions by the lower discoidal nervule; a discal oblique broad band from the second median nervule to the inner margin. *Hindwing* with a narrow pale yellow costal streak; a discal band in continuation of that on the forewing, but narrower, extending broadly and diffusedly on to the abdominal margin; a broader submarginal band anteriorly very attenuated; a narrow marginal line, disconnected in the second median interspace at the base of the tail. UNDERSIDE, *both wings*, ground-colour pearly-white, blotched with burnt-sienna brown or ferruginous; heavily tesselated with black. *Forewing* with a narrow black submarginal line, within which is another black line, disconnected, reaching from the costa to the second median nervule. *Hindwing* with a submarginal series of five more or less cordiform black spots profusely powdered with metallic green and bounded by an outer fine black line; two fine marginal black lines, the inner one from the third median nervule to the abdominal margin broadened out and powdered with metallic green; a metallic green streak anterior to the anal indentation, bounded on both sides by a fine black line.

Described from four male specimens collected by Mr. W. Doherty in Java. I have not seen a female, which sex was unknown to Godart when he described the species. Boisduval's figure clearly represents this species, and not the Indian form which I have described below as *S. sinis*.

10. SYMBRENTHIA SINIS, n. sp., Pl. F, Fig. 9, ♂.

Laogona hypselis, Doubleday and Hewitson (*nec* Godart), Gen. Diurn. Lep., vol. i, p. 191, n. 2, pl. xxv, fig. 1, *male* (1847); id., Wallace, Trans. Ent. Soc. Lond., 1869, p. 344, n. 4; *Symbrenthia hypselis*, de Nicéville (part), Butt. of India, vol. ii, p. 241, n. 535 (1886).

HABITAT: Nipal; North Bengal (*Doubleday* and *Hewitson*); Eastern Kumaon (*Doherty*); Sikkim; Bhutan; Assam; Naga Hills; Cachar; Karen Hills, Dawnat Burma; Perak, Malay Peninsula.

EXPANSE: ♂, 2·0 to 2·2; ♀, 2·1 to 2·3 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* as in *S. hypselis*, Godart. UNDERSIDE, *both wings* with the ground-colour whitish washed with yellow instead of pearly-white; the black tesselations on both wings and the metallic green markings on the hindwing the same; but the blotchings are dark gamboge-colour instead of burnt-sienna brown * throughout.

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* Godart calls them *ferrugineuse*.

I am indebted to Mr. W. Doherty for four male specimens of the true *S. hypselis*, Godart, from Java. The above given differences between it and the North-East Indian and Malay Peninsula form may appear to be trivial, but if specimens of the two species are compared, it will be seen at a glance that the coloration of the underside is totally different.

11. CYRESTIS IRMÆ, Forbes.

C. irmæ, Forbes, A Naturalist's Wanderings in the Eastern Archipelago, p. 274 (1885); id., H. Grose Smith, Ann. and Mag. of Nat. Hist., sixth series, vol. iii, p. 313 (1889); id., Waterhouse, Aid, vol. ii, pl. clxxvi, fig. 2 (1889); *C. manalis*, var. *sumatrensis*, Staudinger, Ex. Schmett., p. 133 (1886).

HABITAT: Hoodjoong, Palembong Residency, Sumatra (*Forbes*); Sumatra (*Staudinger*); Perak, Malay Peninsula.

EXPANSE: ♂, 2·0 and 2·2 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* pure white, all the veins black. *Forewing* with the base of the costa very faintly tinged with ochreous; a short broad longitudinal subcostal black band, which is followed by two broad approximating black lines crossing the discoidal cell obliquely from the costa to the median nervule, and enclosing a narrow space thickly dusted with black scales, these two lines are continued as a single line to the orange anal area of the hindwing; a strongly outwardly-curved black line crosses the cell, its anterior end joined to the outermost of the two lines crossing the cell described above; a narrow black line defining the disco-cellular nervules, which touches the last-described curved line at its middle; immediately beyond the disco-cellular line are a pair of broad black lines from the costa to the third median nervule, enclosing posteriorly a narrow space of the white ground-colour, continued across both wings as a single narrow line until it also becomes lost in the orange anal area of the hindwing; an outwardly curved black line crosses the disc of the forewing, very widely dilated anterior to the lower discoidal nervule, forming in fact a wedge-shaped figure with its base on the costa, this line is also continued across the hindwing till it reaches the orange anal area, a sinuous very broad black line crosses the outer discal area of the forewing from the costa (where it is widely dilated inwardly into a large square-shaped patch) to the inner margin; followed by five broad black lines which are placed so closely together as almost to form one uninterrupted black band occupying the whole of the outer margin, the innermost, however, broken near the middle of the wing, leaving an oval space of the ground-colour; the third line also is shorter than the others, leaving a small portion of the ground-colour in the first median interspace; a round orange patch bearing two black dots in the middle occupies the anal angle of the wing. *Hindwing* has the abdominal margin broadly black; there are three outer-discal approximating broad black lines, which enclose two narrow bluish lines; the outer margin also bearing three other broad black lines, which enclose two very fine pure white lines; between these two groups of three lines there is an elongated wedge-shaped space of the ground-colour, which extends from the discoidal nervule to the costa, its narrowest portion towards the anal angle of the wing; the anal lobe, and the anal area widely as far as the second median nervule orange, bearing seven small round black spots. UNDERSIDE, *both wings* marked very similarly to the upperside, except that all the black lines are narrower, especially those on the outer margin of the forewing. *Forewing* with the orange area at the anal angle smaller. *Hindwing* with the orange area at the anal angle also smaller than on the upperside, and bearing three black spots only, these being larger than those on the upperside. *Thorax* and *abdomen* black, obscurely streaked with whitish above, beneath white. *Palpi* above black, beneath white.

Nearest to *C. mœnalis*, Erichson, of which species I possess four male specimens from Manilla and Mindoro, and from which it may be at once distinguished by the three black lines from the base common to both wings being narrower, and by the middle one of them in the hindwing leaving the fine black line which defines the disco-cellular nervules free, instead of covering them entirely; the orange area of the hindwing is also more extensive; again the prominent steel-blue line crossing the outer-disc of the hindwing and reaching to the second median nervule of the forewing in *C. mœnalis*, is obsolete, being replaced by a bluish line; the veins of the upperside which in *C. mœnalis* are only partially black, are wholly so. From *C. nivea*, Zinken-Sommer, and *C. nivalis*, Felder, it may be known by the three common black lines from the base of the wing being much broader, and all the veins being black, instead of only partially black; from *C. nivea* alone it may be known by the black costal area of the forewing being discontinuous and not joined to the black apical area, the orange areas at the anal angle of both wings are more extensive and of a deeper shade of colour; from *C. nivalis* alone it may be at once distinguished by the strong dilatation on the costa of the forewing of the third common black line from the base of the wings, whereby the white portion of the costal area is greatly reduced; and by the orange area of the hindwing being much more restricted, and ending on the second median nervule instead of extending to the discoidal nervule.

Mr. J. Wray, Junior, Superintendent of the Perak Museum, has kindly sent me three specimens of this pretty and distinct species taken in the Perak Hills at an elevation of between three and four thousand feet above the sea.

Family LYCÆNIDÆ.

Genus SIMISKINA, Distant.

Simiskina, Distant, Entomologist, vol. xix, p. 12 (1886); idem, id., Rhop. Malay., p. 450 (1886); *Massaga*, Doherty, Journ. A. S. B., vol. lviii, pt. 2, p. 429 (1889); idem, id., l. c., vol. lx, pt. 2, p. 35 (1891).

Both sexes with neuration apparently much the same as in *Poritia*, Moore; but in the MALE the *hindwing* has, in addition to the long tuft of almost colourless hairs which spring from near the middle of the discoidal cell, and which are directed forwards and are covered by the inner margin of the forewing, the second tuft of long black hairs placed in a different position; in *Poritia* it springs from near the base of the submedian nervure and lies along the abdominal margin, in *Simiskina* it arises at the lower end of the cell and lies along the base of the third median nervule. Type, *Simiskina fulgens*, Distant, equals *Poritia potina*, Hewitson.

The above diagnosis will perhaps suffice for the present to distinguish the males of this genus from the allied genera. As stated in "The Butterflies of India, Burmah and Ceylon," vol. iii, p. 38, *footnote*, I am unable to use Mr. Doherty's genus *Massaga*, of which the type species is *potina*, Hewitson, (Mr. Doherty in his second paper says that *pediada*, Hewitson, is the type of his genus *Massaga !*), as it is almost certainly the same as Mr. Distant's genus *Simiskina.* I have seen the type specimens of *Simiskina fulgens,* Distant, in Dr. Staudinger's collection, and find that they are conspecific with "*Poritia*" *potina,* Hewitson. The name *Massaga* is also preoccupied, having been used by Mr. Francis Walker for a genus of African Moths in part ii. of his "List of the Specimens of Lepidopterous Insects in the collection of the British Museum," page 358 (1854). I give below a key to the genera of the *Poritia* group by which it should be easy to recognise them all.

Key to the genera of the Poritia group of Lycœnidœ.

A. Both sexes, forewing, first subcostal nervule completely anastomosed with costal nervure, except a very short free basal portion.
  a. Both sexes, forewing with four subcostal nervules.
    a^1. Male with no secondary sexual characters.
      ZARONA, type *jasoda,* de Nicéville.
    b^1. Male, hindwing, upperside with a cellular tuft of long hairs (*Distant*).
      DERAMAS, type *livens,* Distant.
  b. Both sexes, forewing, with three subcostal nervules; male with a tuft of hairs on upperside of hindwing springing from middle of cell.
    a^1. Male, hindwing, upperside with a second tuft of hairs springing from near base of submedian nervure, and lying along abdominal margin.
      PORITIA, type *hewitsoni,* Moore.
    b^1. Male, hindwing, upperside with second tuft of hairs springing from lower end of cell, and lying along base of third median nervule.
      SIMISKINA, type *potina,* Hewitson.

12. SIMISKINA PHARYGE, Hewitson, Pl. F, Fig. 11, ♀.

Poritia pharyge, Hewitson, Trans. Ent. Soc. Lond., 1874, p. 345; idem, id., Ill. Diurn. Lep., p. 215, n. 5, pl. lxxxviii, figs. 8, 9, *male* (1878); id., Distant, Rhop. Malay., p. 450, n. 8, pl. xli, fig. 8, *male* (1886); *Zarona ? pharyge,* de Nicéville, Butt. of India, vol. iii, p. 35 (1890).

HABITAT: Borneo (*Hewitson*); Perak (*Distant*); Renong, Western Siam (*Doherty*).

EXPANSE: ♀, 1·5 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* and *cilia* shining smoky-brown without markings. UNDERSIDE, *both wings* paler brown than above, without gloss; a rather indistinct darker brown discocellular line; a discal and a submarginal irregular darker brown line, the discal line outwardly, the submarginal line inwardly, defined by a line of a paler shade of brown than the ground-colour, the discal line on the forewing is dislocated at the third median nervule, its posterior portion being shifted inwardly; on the hindwing this line is highly zigzaged throughout its course, and whereas on the forewing it is straight, on the hindwing it is highly curved, following the outline of the outer margin of the wing; there are also traces in the hindwing of a third line from the third median nervule to the abdominal margin placed anterior to the discal line, this inner discal line being very prominent in the male; the submarginal line much more distinct on the hindwing than on the forewing, more lunular, and towards the anal angle outwardly defined with black narrowly; a conspicuous marginal light blue line from the third median nervule to the anal angle, narrowly defined on both sides with black and constricted on the interspaces between the veins; this blue line is followed by a very fine orange line on the extreme margin.

Nearest to *Poritia pediada*, Hewitson, from which it may at once be known by the presence of the light blue marginal line on the underside of the hindwing.

I am indebted to Mr. J. Wray, Junior, for a pair of specimens of this lovely species captured in Perak; from one of these the above description is taken. The male on the upperside hardly differs in the smallest detail from the same sex of *Simiskina pediada*, Hewitson, of which Mr. Doherty has lent me a specimen taken by himself in Mergui, Burma. On the underside, however, the two species differ widely in both sexes.

13. SIMISKINA PHERETIA, Hewitson.

Poritia pheretia, Hewitson, Trans. Ent. Soc. Lond., 1874, p. 346; idem, id., Ill. Diurn. Lep., p. 217, n. 9, *P. pheretria*, pl. lxxxix, figs. 17, 18, *male*; 16, *female* (1878); id., Distant, Rhop. Malay., p. 200, n. 5, pl. xxii, fig. 9, *male*; 10, *female* (1884); id., de Nicéville, Butt. of India, vol. iii, p. 46 (1890).

HABITAT: Singapore (*Hewitson*); Perak.

Mr. J. Wray, Junior, has kindly sent me a single damaged male specimen of what I believe to be this species. The blue coloration of the upperside is much darker and richer than is shown in Hewitson's figure, being of quite an ultramarine-blue tint; the blue spots on the forewing are larger, as is also the black spot in the middle of the blue area on the hindwing, which really consists of two conjoined spots in my specimen. On the underside of the forewing there is an indistinct submarginal whitish line not mentioned by Hewitson in his description of the male, but stated to be present in the female; all the markings of the hindwing less distinct than in his figure. The tufts of hairs on the upperside of the hindwing in my specimen have been largely destroyed, but sufficient remain to enable me to place the species in this genus with considerable certainty.

14. CYANIRIS COALITA, n. sp., Pl. F, Figs. 12, ♂; 13, ♀.

HABITAT: Java.

EXPANSE: ♂, 1·4; ♀, 1·1 to 1·3 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rather pale lavendar-blue. *Forewing*, costa narrowly black, with an indistinct irrorated patch of white scales in the middle of the disc, almost obsolete in one specimen. *Cilia* anteriorly black, white at the anal angle, and for a short distance thence along the inner margin. *Hindwing* with an irrorated patch of white scales from the middle of the costa to about the discoidal nervule; a black anteciliary thread. *Cilia* white, but bearing a black line towards the base. UNDERSIDE, *both wings* bluish-white; the termination of the discoidal cells marked with a brownish line as usual; a submarginal lunulated line, enclosing an elongated spot in the forewing and a round one in the hindwing between it and the margin in each interspace, except the submedian interspace of the hindwing which has two. *Forewing* with a prominent spot below the costa about midway between the disco-cellular streak and discal band, the latter consisting of four distinct and prominent portions, one in each interspace from the upper discoidal to first median nervule, and almost coalescing with the submarginal lunulated line. *Hindwing* with the basal and discal spots as usual in the genus. FEMALE. UPPERSIDE, *both wings* fuscous. *Forewing* with a large patch of white occupying the whole of the disc, extending from the middle third of the inner margin to the subcostal nervure; this patch in some lights irrorated with very pale metallic blue. *Hindwing* bearing a similar patch on the disc. UNDERSIDE, *both wings* marked as in the male, but the spots (especially the discal macular band on the forewing) more prominent.

C. coalita is very near to *C. dilectus*, Moore, and on the upperside the males of these two species do not differ. On the underside, however, the discal macular band of the forewing almost runs into the submarginal band (it quite does so in the female) in *C. coalita*, but is quite distinct and well-separated from it in *C. dilectus*. The female of *C. coalita* differs from that of *C. dilectus*—as identified by me from Simla specimens—in the presence of a large pure white discal area on the upperside of both wings glossed with metallic pale blue; and the hindwing having the outer margin broadly and regularly black, while in *C. dilectus* there is no trace of such a band, but instead there is a submarginal lunulated black line, beyond which is a series of round black spots, one in each interspace. I trust that there will be no difficulty in recognising this species; it appears to be quite distinct.

Described from two pairs captured by Mr. W. Doherty on Mount Arjuno, Eastern Java, at an elevation of from 4,000 to 5,000 feet above the sea.

15. LAMPIDES LATIMARGUS, Snellen, Pl. F, Fig. 14, ♂.

Cupido latimargus, Snellen, Tijds. voor Ent., vol. xxi, p. 19, n. 88, pl. i, fig. 4, *male* (1878); *Lampides latimargus*, Holland, Proc. Boston Soc. Nat. Hist., vol. xxv, p. 72, n. 90 (1890).

HABITAT: Celebes.

EXPANSE: ♂, 1·0 to 1·8 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* pale purplish-blue, with broad fuscous outer margins, the linear white markings of the underside shewing through the wings faintly by transparency. *Forewing* with the fuscous band on the outer margin bearing in its middle an indistinct pale line. *Hindwing* with the fuscous band on the outer margin bearing a double series of white lunules, those in the first median interspace enclosing a deep black spot. UNDERSIDE, *both wings* pale stone-colour; the outer margins bearing three whitish lines, the ground-colour between them rather darker than the rest of the wing, the middle line on both wings, and the inner line on the hindwing, lunulated. *Forewing* with the characteristic white lines or strigæ arranged as follows:—Nos. 1 and 2 from the base of the wing parallel and continuous, commencing on the costal and ending on the submedian nervure; No. 3 is broken and curved, commences on the costa and ends on the second median nervule; No. 4 also broken and curved, commences on the costa and ends on the third median nervule. *Hindwing* crossed by the usual basal lines; a large round black spot on the margin in the first median interspace, narrowly crowned with dull orange, and bearing a few metallic blue scales on the edge nearest the anal angle; the anal angle bears two minute clumps of metallic blue scales.

L. latimargus is probably the largest species in the genus, the above described specimen measuring 45 mm., though Herr Snellen gives only 25—38 mm. for the specimens he described. The breadth of the outer black border to both wings on the upperside is also a very noticeable feature. It comes into the group of the genus which is represented in my collection by

1. *L. elpis*, Godart.
2. *L. kankena*, Felder (*L. insularis*, Röber, is a synonym of this species).
3. *L. kondulana*, Felder (*L. cærulea*, Druce, is probably a synonym of this species).
4. *L. latimargus*, Snellen.
5. *L. callistus*, Röber.
6. *L. bochides*, de Nicéville.

In all these species the characteristic strigæ are similarly arranged, and are as described above.

In the next group represented in my collection by

1. *L. suidas*, Felder.
2. *L. pseudelpis*, Butler.
3. *L. coruscans*, Moore.
4. *L. philatus*, Snellen.
5. *L. subdita*, Moore.
6. *L. osias*, Röber.

the characteristic strigæ instead of being continuous throughout their course are arranged as follows:—Nos. 1 and 2 are short, and extend from the subcostal nervure to the third median nervule only, while Nos. 3 and 4 are long, and reach from the subcostal to the submedian nervure, but that portion of each of these strigæ posterior to the second median nervule is dislocated and shifted inwards towards the base of the wing, so that the lower portion of No. 3

striga is joined to No. 1, or lies between it and No. 2, thereby forming with them a Y-shaped figure, of which the Nos. 1 and 2 strigæ represent the converging arms ; while the lower portion of No. 4 striga is joined on to, and is continuous with, No. 3. This arrangement of the characteristic strigæ is found usually in the *L. ælianus* group, which, however, may be known from the two groups above mentioned by the males being coloured bluish milky-white on the upperside instead of metallic azure-blue; and more notably still by the characteristic strigæ Nos. 1 and 2 being continued right up to the costa in disconnected dots, this feature never obtaining in the other two groups. This third group is represented in my collection by

1. *L. ælianus*, Fabricius.
2. *L. celeno*, Cramer.
3. *L. aratus*, Cramer (*L. masu*, Doherty, is a synonym of this species).
4. *L. cleodus*, Felder.
5. *L. kinkurka*, Felder.
6. *L. pura*, Moore.

I have re-described *L. latimargus* from a single example, for which I am indebted to the collector, Mr. W. Doherty.

I made a terrible muddle of three species of this genus in "The Butterflies of India," although there is no part of that volume on which more care was expended. Having since visited Europe and examined the types of *L. coruscans*, Moore, *L. kondulana*, Felder, and *L. kankena*, Felder, I am now able to correct my previous mistakes. *L. coruscans* is a very distinct species, and is probably confined to the island of Ceylon. It is very deep rich blue on the upperside in the male approaching my *L. bochides* in that respect; on the underside of both wings in both sexes the second and third white lines from the outer margin are highly zigzaged, which character in Indian species is only found in *L. subdita*, Moore, a species which in other respects is abundantly distinct.

With regard to *L. kondulana*, Felder, all my remarks on page 173 of my book refer to *L. kankena*, Felder. *L. kondulana* is what I mistook for *L. coruscans;* my remarks on pages 163 and 164 refer, therefore, to *L. kondulana*. The male is rich blue on the upperside, and the species may be known from *L. elpis*, Godart, by this colour being of a deeper shade. It is also a smaller insect to judge from all the specimens of it I have seen. The female is unknown. It occurs in the Nicobars, Burma, and the Malay Peninsula.

With regard to *L. kankena,* I have carefully described it on page 173 of my third volume under *L. kondulana.* It is a good species, and is represented in my collection by specimens from the Nicobar and Philippine Isles, from which latter locality it has been described by Herr Röber under the name of *insularis.*

All these three species seem to be extremely rare. I trust that no one will now have any further difficulty in identifying them should they obtain specimens of them.

16. LAMPIDES BOCHIDES, n. sp., Pl. F, Fig. 15, ♂.

HABITAT: Malay Peninsula, Sumatra, Borneo.

EXPANSE: ♂, 1·45 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rich dark metallic blue, rather darker and of a more purple shade on the forewing than on the hindwing. *Forewing* with a narrow black outer margin, widest at the costa, fining down to nothing at the anal angle. *Hindwing* with a fine white line within the black anteciliary thread; two fine black lines, the anterior half the length of the posterior, at the anal angle, divided by a fine white line. UNDERSIDE, *both wings* dark reddish stone-colour, the whitish markings arranged as described for *L. latimargus,* Snellen, but they are all much narrower, and the third characteristic striga of the forewing instead of being continuous, has its lowest fragment in the second median interspace shifted outwards, so that this fragment forms the basal portion of a Y-shaped figure, of which the upper portion of No. 3 striga and No. 4 striga form the two arms. *Hindwing* with the large anal black spot surrounded by a broader and deeper orange ring than in *L. latimargus.*

L. bochides appears to be a connecting link between the *elpis* group of the genus *Lampides* and the genus *Jamides.* It is certainly the richest coloured species yet described, though still the metallic lustre comes far behind that of *Jamides bochus,* Cramer. Next in richness of colouring follows *L. coruscans,* Moore, apparently confined to the Island of Ceylon, and to be known from its near allies by the highly lunate character of the second and third lines from the outer margin of both wings on the underside; then follows *L. kondulana*, Felder, of which I possess specimens from the Nicobar Isles, whence it was described, and from the Malay Peninsula. The markings and ground-colour of the underside in *L. bochides* are almost exactly the same as in *J. bochus*.

Described from a single example from S.-E. Borneo, kindly given to me by Mr. W. Doherty.

17. LAMPIDES PHILATUS, Snellen, Pl. F, Fig. 16, ♂.

Cupido philatus, Snellen, Tijds. voor Ent., vol. xxi, p. 21, n. 89, pl. i, fig. 5, *male* (1878); *Lampides philetus*, Holland, Proc. Boston Soc. Nat. Hist., vol. xxv, p. 72, n. 91 (1890).

HABITAT: Celebes.

EXPANSE: ♂, 1·4 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* pale blue with a very slight gloss. *Forewing* with the outer margin rather broadly blackish, fining away to nothing at the anal angle. *Hindwing* with an anteciliary fine black thread; then a similar white thread broken on the veins; then a series of five oval blackish spots placed one in each interspace; beyond which, lastly, there is a series of hastate blackish marks also one in each interspace; the submedian interspace at the anal angle bears two parallel blackish lines in place of the oval spot and hastate mark of the other interspaces. UNDERSIDE, *both wings* dull hair-brown, basally somewhat paler; a fine pure white anteciliary thread, followed by two fine zigzag white lines, the inner one of these on the hindwing is extraordinarily zigzaged; the space on that wing enclosed by these two lines deep black. *Forewing* with two short fine parallel lines at the end of the discoidal cell; a pair of fine discal lines starting from near the costa and ending on the submedian nervure, slightly broken and shifted inwardly posterior to the second median nervule. *Hindwing* with the usual basal and discal broken fine white lines, but those towards the base obsolete.

L. philatus is probably nearest to *L. subdita*, Moore, from which it may be known by its paler blue coloration on the upperside, the broad blackish border to the forewing, the prominent marginal markings of the hindwing, the second and third white lines from the outer margin of both wings on the underside being more strongly zigzaged, and especially by the entire absence (as in *L. anops*, Doherty) of an orange subanal spot on the hindwing in the submedian interspace, which is so large and conspicuous in *L. subdita*. *L. philatus* is a very distinct species.

Described from a single example, which I owe to the generosity of my friend, Mr. W. Doherty.

18. ACESINA ARISBA, n. sp., Pl. F, Fig. 19, ♂.

HABITAT: Burma (Tilin Yaw and Maulmain).

EXPANSE: ♂, 1·3 to 1·5; ♀, 1·2 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* shining bluish-purple. *Forewing* with the costa narrowly, the outer margin somewhat broadly black, broadest at the apex; *cilia* anteriorly black, becoming white towards the anal angle. *Hindwing* with the costa broadly, the outer margin less broadly and decreasingly towards the anal angle black, bearing from the anal angle to the second median nervule a very fine marginal bluish-purple line. *Tail* narrow, black, tipped with white. UNDERSIDE, *forewing* with the ground-colour of the basal half brown, of the outer half grey; the markings similar to those in *A. paraganesa*, de Nicéville, but differing from *A. aberrans*, de Nicéville, in that the discal band is continuous instead of strongly broken in the middle. *Hindwing* similarly coloured and marked as in the same wing of *A. aberrans*. FEMALE. UPPERSIDE, *forewing* as in *A. aberrans*, but having a single whitish spot beyond the disco-cellular black spot only, and lacking the two black spots divided by the second median nervule more or less present in that species. *Hindwing* as in *A. aberrans*. UNDERSIDE, *both wings* as in the male.

The male may at once be known from *A. aberrans* by the outer black border to both wings on the upperside being over a millimeter in breadth, instead of being reduced to a fine line only; the female is distinguished by having one whitish spot only on the forewing; both sexes may be known by the unbroken discal band of the forewing on the underside.

Described from four males and a female in my collection taken by Lieutenant E. Y. Watson at Tilin Yaw, Burma, in March and April, 1890. He has also kindly sent me four males and two females of

A. aberrans, taken by him in the same locality and at the same time. I took a single male at Maulmain in October, 1891.

19. ARHOPALA AMATRIX, n. sp., Pl. G, Figs. 23, ♂; 24, ♀.

HABITAT: Burma.

EXPANSE: ♂, 2·0 to 2·2; ♀, 2·2 inches.

DESCRIPTION: MALE. UPPERSIDE, *forewing* shining ultramarine-blue, the costa narrowly, the outer margin broadly—especially at the apex—black. *Hindwing* with an elongated basal patch of shining ultramarine-blue occupying the whole of the discoidal cell and extending beyond it on all sides, crossed by the black veins; the costa, outer, and abdominal margins broadly fuscous; *tail* broad, rather long, fuscous, tipped with white, a small tooth-like projection from the termination of the second, and a smaller one still from the third median nervule. UNDERSIDE, *both wings* brown washed with pale lavender. *Forewing* with a small rounded dark white-ringed spot towards the base of the discoidal cell, a larger one across the middle, and a still larger one closing the end of the cell, its outer edge very irregular; a rounded spot at the base of the first median interspace; an elongated brown streak or band in the submedian interspace, occupying its basal three-fourths; a discal macular band of five rounded spots, the middle one cordate, much out of line with the rest, shifted outwardly; two obscure marginal bands. *Hindwing* with four subbasal rounded spots extending across the wing, another spot in the costal interspace, touching the costal nervure, one in the middle of the cell; a highly irregular discal bifurcated macular band; a waved submarginal band, and a marginal obscure band bearing from the second median nervule to the anal angle some very obscure dark green metallic scales; anal lobe bearing a prominent round deep brown (almost fuscous) spot. FEMALE. UPPERSIDE, *forewing* with the blue coloration much more restricted than in the male, bounded anteriorly sharply by the disco-cellular nervules. *Hindwing* as in the male. UNDERSIDE, *both wings* as in the male.

Close to *A. amantes*, Hewitson, from Ceylon and the continent of India, from which it differs in the blue coloration of the upperside being much more restricted in both sexes, and in the outer black borders being hence much broader. It is a little peculiar too in having the blue coloration of the hindwing of equal extent in both sexes, in *A. amantes* it is more restricted in the female than in the male, in the female of *A. amatrix*, however, it is of less extent than in the same sex of *A. amantes*. In "The Butterflies of India," vol. iii, p. 240, I wrote under *A. amantes*:—"I possess a single female specimen from Maulmain, Burma, which differs from the typical form in that the anal lobe on the underside of the hindwing is centred with reddish-brown instead of deep black; the blue coloration of the forewing on the upperside extends well above the discoidal cell nearly reaching the costa and beyond the cell also, in the hindwing it is more restricted to the base." These remarks apply to the male of *A. amatrix*, true *A. amantes* apparently not occurring in Burma.

Described from three males and two females from Tilin Yaw, Upper Burma, captured by Lieutenant E. Y. Watson in April, May, and June, 1890, one female from Maulmain obtained by Major C. H. E. Adamson, and another female from Nubboo Chang captured by Major C. T. Bingham.

20. ARHOPALA ALEMON, n. sp., Pl. F, Figs. 20, ♂; 21, ♀.

HABITAT: Burma.

EXPANSE: ♂, 1·5 to 1·6; ♀, 1·7 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* rather dark obscure shining purple. *Forewing* with the costa narrowly, the outer margin evenly and rather broadly black. *Hindwing* with the costa, outer, and abdominal margins more broadly black than in the forewing; *tail* rather long, moderately robust, black tipped with white. UNDERSIDE, *both wings* pale brown washed with shining violet. *Forewing* with the inner margin broadly paler; a small rounded dark pale-ringed spot towards the base of the discoidal cell, an elongated spot across its middle, and a third closing the cell; two spots below the cell divided by the first median nervure; a discal slightly curved regular macular band; two indistinct marginal fasciæ. *Hindwing* with the four usual spots arranged across the base of the wing, a fifth below the middle of, but touching the costal nervure, a sixth in the middle of the cell—all these spots very small; an elongated spot closing the cell, joined posteriorly to two other spots divided by the first median nervule, these three spots together forming an inner discal fascia, which is quite separated from the outer discal fascia, this latter consists of two spots touching each other and divided by the first subcostal nervule, then four spots forming almost a straight line and separated from the two costal spots, being shifted outwardly out of line with them, then two or three spots placed internal to the four on the middle of the disc, curved upwards to the abdominal margin; two submarginal fasciæ more prominent than in the forewing; a small anal lobe centred with reddish-brown. FEMALE. UPPERSIDE, *both wings* with the purple coloration more restricted than in the male, and of a lighter and brighter shade. *Forewing* with a prominent black spot at the end of the cell, on either side of which is a small shining whitish patch more distinctly visible in some lights than in others. UNDERSIDE, *both wings* paler brown than in the male, less silky, and usually barely washed with violet; all the markings larger, but less prominent than in the male.

Very near to *A. rama*, Kollar, which occurs probably all along the Himalayas, in Burma, and in Central China. Both sexes of *A. alemon* differ from those of *A. rama* in having the purple coloration of the upperside more extensive, the tail of the hindwing twice as long (in *A. rama* it is little more than a tooth); the female differs conspicuously in possessing a black patch at the end of cell of the forewing flanked on either side by a shining whitish patch, a feature wholly wanting in *A. rama*. The ground-colour of the underside of both sexes is also paler, and the discal band of the forewing broader and more regular. In the "Butterflies of India," vol. iii, p. 252, I expressed the opinion that these Burmese specimens were not sufficiently distinct from *A. rama* to warrant their description as a distinct species; but Lieutenant E. Y. Watson, who has taken both species side by side in the Tilin Yaw, Upper Burma, assures me that they are quite distinct, so I have at his suggestion described them. It is also allied to *A. khamti*, Doherty, from Margherita, Upper Assam, but wholly lacks the "large subanal ocellus bordered with metallic green, which extends to the first median nervule" and the "dark spot edged with whitish in the first median interspace" of the hindwing on the underside, which are said to be characteristic of that species.

Described from six males and four females taken in the Tilin Yaw in March and April by Lieutenant Watson; a male from the Meplay Valley taken in January, a female from the Donat Range, also taken in January, and another in the Thaungyin forests taken in March, all by Major C. T. Bingham.

21. ARHOPALA BASIVIRIDIS, n. sp., Pl. G, Fig. 22, ♂.

HABITAT: Malay Peninsula; Borneo.

EXPANSE: ♂, 1·7 to 2·0; ♀, 1·8 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* and *cilia* fuscous. *Forewing* with the basal third brilliant refulgent metallic green, occupying the discoidal cell entirely and extending slightly above it, reaching to the inner margin and extending along it two-thirds of its length. *Hindwing* with a smaller similarly-coloured basal patch, which occupies the whole of the discoidal cell and extends a little beyond it on all sides. UNDERSIDE, *both wings* dark hair-brown. *Forewing* with the inner margin broadly a little paler; a round spot towards the base of the discoidal cell, an oval larger spot across the middle, and a still larger quadrate one closing it; above the latter is a spot on the costa; below it is a spot occupying the base of the first median interspace; a large ill-formed spot in the submedian interspace below the middle spot in the cell; the discal band consists of eight well-formed spots, the band broken in the middle, the four lower spots shifted inwards considerably; the usual submarginal and marginal lunular lines. *Hindwing* with the usual four round basal spots, an oblong spot closing the cell and joined to the irregular discal band and forming therewith a somewhat Y-shaped figure; marginal and submarginal lines as in the forewing; the anal angle bearing a prominent round deep black spot, with two smaller oval-shaped ones, one on each side of the tail, all three spots surmounted by rich metallic green irrorations; *tail* rather long, slender, fuscous tipped with white. FEMALE. UPPERSIDE, *both wings* as in the male, but the green colour (which is of the same extent) replaced by rich purple. UNDERSIDE, *both wings* as in the male.

This species appears to have been twice described before, first by Horsfield as the female of *A. eumolphus*, Cramer, as follows:—FEMALE. UPPERSIDE, *both wings* "black, the greenish golden lustre being limited, in the forewings to a medial patch extending to the base, and in the hinder to a triangular spot occupying the basal areolet;" and recently by Mr. Distant, thus:—"FEMALE [of *Narathura farquhari*, Distant]. Resembling the male in hue, but the anterior wings above with a broad costal and outer marginal dark fuscous fascia; this dark colour being broadest at the apex." Both these authors have mistaken the sex of the specimens they described, as the females of the green group of *Arhopalas* are always blue or purple on the upperside.*

A. basiviridis differs from all the species of the *A. eumolphus* group in having the peacock-green colour of the upperside in the male restricted to the base of the wings, and the ground-colour of the underside dark hair-brown without any gloss whatever.

Described from two male examples from Johore in the Malay Peninsula and a pair from Borneo, all kindly given to me by Mr. W. Davison of the Raffles Museum, Singapore. It has also been obtained by Mr. W. Doherty ("Butt. India, Burmah and Ceylon," vol. iii, page 227, *note*), who first pointed out its distinctness, in the Malay Peninsula and Borneo, and I have seen specimens of it at Dresden in Dr. O. Staudinger's magnificent collection. Mr. Doherty informs me that he has obtained it in Lower Tenasserim, S.-W. Sumatra, and probably the same species in E. Java.

Genus SATSUMA, Murray.

In "The Entomologist's Monthly Magazine," vol. xi, p. 168 (1875), the Rev. R. P. Murray characterises the genus *Satsuma*, the type species of which is the *Thecla frivaldszkyi* of Lederer, =*Thecla cærulescens*, Motschulsky, =*Lycæna ferrea*, Butler, a Japanese and Amurland butterfly. Two other species have recently been added to the genus by Mr. J. H. Leech, *vide* "The Entomologist," vol. xxiii, pp. 43 and 44 (1890), both described from unique male examples, *S. chalybeia* from Chang Yang, and *S. pratti* from Ichang, in Central China. A fourth species from the Khasi Hills will probably have to be added, as I have recently received an undoubted female *Satsuma* from the Rev. Walter A. Hamilton, by whose native collectors it was obtained last year. Most unfortunately, ants, those horrible pests of the tropics, got at this and other specimens of mine on the journey from Bombay to Calcutta, and completely devoured the abdomen. I have, however, had the specimen, which is otherwise quite fresh and perfect, drawn (Plate F, fig. 17, ♀), but owing to its mutilated state, and the females of two out of the hitherto known species of the genus being undescribed, shall not give it a name. It may be described as follows:—FEMALE. UPPERSIDE, *both wings* pale blue. *Forewing* with the costa broadly black, that colour reaching to the subcostal nervure, the apex very broadly and the outer margin also broadly but decreasingly black. *Hindwing* with the costa and apex rather broadly, the outer margin narrowly pale fuscous; a fine black anteciliary thread; the *cilia* cinereous. UNDERSIDE, *both wings* ferruginous, rather darker on the hindwing. *Forewing* with an irregular darker discal line, commencing on the costa and ending on the first median nervule, outwardly defined with whitish; the inner margin broadly pale fuscous. *Hindwing* with very indistinct discal and submarginal lines; the abdominal margin and anal lobe heavily sprinkled with black scales. The upperside of this species agrees with the description of *S. chalybeia*, but the underside is ferruginous not grey, and the forewing has no discoidal spot. The markings and ground-colour of the underside are almost exactly as in Japanese males of *S. frivaldszkyi* in my collection, but the latter is considerably paler and the former are far less distinct: whether these are specific or sexual differences I am unable to say. Lederer's figure appears to portray a very small female specimen, though he describes it as a male. The figure is very rough and barely recognisable.

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* The green group of *Arhopalas*, as far as I know them, consists of the following species:—

1. *A. eumolphus*, Cramer, Nipal, Sikkim, Assam, Chittagong Hill Tracts, Java.
2. *A. farquhari*, Distant, Burma, Malay Peninsula, S.-E. Borneo.
3. *A. basiviridis*, de Nicéville, Malay Peninsula, Borneo.
4. *A. hellenore*, Doherty (= *A. viridissima*, Swinhoe), Burma.
5. *A. aurea*, Hewitson, Borneo.
6. *A. trogon*, Distant, Malay Peninsula.

As regards the genus *Satsuma* I think it should be sunk as a synonym of *Thecla*, Fabricius, as restricted in "The Butterflies of India, Burmah and Ceylon," vol. iii, p. 297. In neuration it is practically identical with true *Thecla*. Mr. Murray in his diagnosis of the genus, lays stress upon the fact that the second subcostal nervule of the hindwing is given off further from the base in *Satsuma* than in *Thecla*, but obtains to such a trifling extent as to be hardly worth mentioning. The males of *Satsuma* have precisely the same curious "male-mark" in the forewing as is found in *Thecla*, the neuration at the apex of the discoidal cell in consequence differing in the opposite sexes. *Satsuma* has the outer margin of the forewing slightly, and of the hindwing more prominently "elbowed," and the anal angle of the latter wing is produced into a lobe, but all these features are found also in the type species of the genus *Strymon* of Hübner, which I also consider to be a synonym of *Thecla*.

22. RAPALA REFULGENS, n. sp., Pl. F, Fig. 18, ♂.

HABITAT: Khasi Hills.

EXPANSE: ♂, 1·4 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* black, but more or less overlaid with a rich purple gloss of almost exactly the same shade as is found in the male of *Lehera eryx*, Linnæus. *Forewing* with the purple gloss confined to the basal half of the wing, leaving the costa, apex, and outer margin all broadly black. *Hindwing* with the outer margin narrowly black, the costa and abdominal margin broadly pale fuscous; anal lobe black, bearing outwardly a few turquoise-coloured scales, inwardly orange, anterior to which again is a small white patch on the extreme margin. *Cilia* of the forewing black, of the hindwing also black but narrowly tipped with white. *Tail* black with a white tip. UNDERSIDE, *both wings* uniform pale buff. *Forewing* with two short dark lines (the outer one outwardly defined with whitish) at the end of the discoidal cell; a particularly even slightly recurved prominent darker discal band, not quite reaching the costa, ending posteriorly on the submedian nervure, made up of an inner darker portion outwardly sharply defined on both sides by a fine white line; an inconspicuous darker marginal fascia. *Hindwing* with the discoidal markings as in the forewing, but larger and more prominent; a similar discal band but strongly dislocated in the middle, broken up into three portions, the posterior portion curved upwards to the abdominal margin; a marginal series of whitish lunules; the anal lobe large, jet-black;

above it is a short line of orange defined on both sides by turquoise-coloured scales; a large round subanal jet black spot in the first median interspace, broadly surrounded with orange; the space between it and the anal lobe sprinkled with turquoise-coloured and white scales; a fine white marginal line, outwardly defined by an antecilary black thread.

I do not know any species to which *R. refulgens* is closely allied, or with which it can be compared. The purple gloss of the upperside is visible in all lights, which is quite an unusual feature in the males of species of this genus. I am still unable to identify "*Deudorix*" *rectivitta*, Moore, from North Cachar, but my species obviously differs from it by the character of the anal and subanal spots of the hindwing on the underside.

Described from a single example kindly given to me by the Rev. Walter A. Hamilton, by whose native collectors it was obtained in the Khasi Hills.

Family HESPERIIDÆ.

23. CALLIANA PIERIDOIDES, Moore, Pl. G, Fig. 25, ♀.

C. pieridoides, Moore, Proc. Zool. Soc. Lond., 1878, p. 687, pl. xlv, fig. 2, *male*; id., Doherty, Journ. A. S. B., vol. lviii, pt. 2, p. 133 (1889).

Habitat: Assam.

Expanse: ♀, 2·8 inches.

Description: Female. Upperside, *both wings* and *cilia* dull hair-brown. *Forewing* with a very large oval spot occupying the outer end of the discoidal cell, but not quite reaching the disco-cellular nervules; a circular spot towards the base of the second median interspace, an oval spot rather larger than the spot above it in the middle of the first median interspace—these spots lustrous semi-transparent white; the spot in the cell is anteriorly continued broadly to the costa in an opaque snow-white patch. *Hindwing* with the black spots of the underside shewing through obscurely. Underside, *both wings* with the ground-colour a little paler than above, slightly washed with vinous. *Forewing* with the spots as above, but with an additional small rounded opaque white spot in the middle of the submedian interspace placed somewhat near the outer margin. *Hindwing* with a large rounded black spot close to the outer end of the cell, with eight smaller black spots round the cell placed one in each interspace, of which the fourth, fifth, and seventh are smaller than the others. *Thorax* and *abdomen* concolorous with the wings. *Palpi* (all except the short third joint which is deep black) bright-chrome-yellow.

Though the female of this species differs so markedly in coloration from its brilliantly snow-white male, I have no doubt whatever that I have correctly paired the sexes. The position of the large spot at the end of the discoidal cell of the forewing and the black spots on the disc of the hindwing is the same in both, otherwise the sexes are strikingly dissimilar in appearance. The palpi are bright chrome-yellow also in both sexes, all except the terminal joint; but the thorax of the female is brown throughout, while in the male it is anteriorly bright chrome-yellow. Mr. Doherty (l. c.) was evidently perfectly correct in conjecturing that the female of this rare butterfly would be "dark-coloured."

Described from a single example in Mr. H. J. Elwes' collection obtained by the Revd. Walter A. Hamilton's native collectors in the Khasi Hills, Assam. Mr. Hamilton has given me three males from the same locality.

24. CELÆNORRHINUS CLITUS, n. sp., Pl. G, Fig. 26, ♂.

HABITAT: Assam.

EXPANSE: ♂, 2·2 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* fuscous. *Forewing* with the base overspread somewhat sparsely with yellow hair-like scales; three subapical dots, which form an oblique line whose inner edge is straight, but the outer irregular owing to the spots varying in size, the uppermost being oblong, and twice the size of the middle smallest spot; two small elongated spots divided by the lower discoidal nervule placed below the subapical series and about co-equal in size with the uppermost of these; a large irregularly-shaped spot across the discoidal cell at about two-thirds of its length from the base, the inner edge of the spot straight, its lower half outwardly produced, and therefore larger than the anterior half; a narrow outwardly-obliquely-placed spot in the middle of the second median interspace; a much larger one across the middle of the first median interspace; three spots in the submedian interspace, the two anterior ones placed against the first median nervule, the posterior one against the submedian nervure, the innermost spot somewhat rounded, placed a little beyond one-third of the length of the wing from the base, the outermost spot narrow, placed inwardly obliquely somewhat near to the outer margin of the wing, the third spot co-equal in size to the first, and placed half as near to the second spot as it is to the first—all these spots lustrous semi-transparent white. *Cilia* fuscous. *Hindwing* bearing eleven large rounded bright chrome-yellow spots in three series, the upper of two, the middle of four, and the lower of five; the base and abdominal margin of the wing clothed with long yellow setæ. *Cilia* anteriorly fuscous, posteriorly and along the abdominal margin bright chrome-yellow. UNDERSIDE, *both wings* with the ground-colour of a duller, more hair-brown shade. *Forewing* with an obscure dull yellow streak at the base of the discoidal cell; the inner margin sharply bounded anteriorly by the submedian nervure pale ochreous; the spots as above. *Hindwing* with the spots as above but rather larger and of a duller shade of yellow; some short obscure dull yellow streaks at the base and along the abdominal margin of the wing; an additional irrorated spot near the apex of the wing. *Antennæ* with the shaft and club anteriorly dull ochreous, posteriorly fuscous. *Thorax* concolorous with the wings. *Abdomen* narrowly but prominently striped with yellow.

It is difficult to say to which species *C. clitus* is nearest allied, though perhaps it exhibits a greater resemblance to *C. flavocincta*, de Nicéville, than to any other species. The disposition of the spots on both wings is very distinctive, those on the forewing being apparently scattered evenly over the entire surface, in the hindwing arranged in regular rows.

Described from a single example in Mr. H. J. Elwes' collection obtained by Mr. W. Doherty in July or August, 1889, in the Naga Hills, Assam, at an elevation of 5,000—8,000 feet.

25. NOTOCRYPTA NEÆRA, n. sp., Pl. G, Fig. 27, ♀.

HABITAT: Perak.

EXPANSE: ♂, ♀, 1·25 to 1·35 inches.

DESCRIPTION: MALE and FEMALE. UPPERSIDE, *both wings* shining brownish-fuscous; *cilia* concolorous with the wings. *Forewing* with a broad medial tripartite semi-transparent lustrous white patch, which is made up of a large quadrate portion towards the end of the discoidal cell ; a similar portion below it, but shifted outwardly somewhat, towards the base of the first median interspace ; and a very small portion occupying the base of the second median interspace, its outer edge extending beyond the outer edge of the portion below it. *Hindwing* unmarked. UNDERSIDE, *both wings* dark brown without any gloss, thinly sprinkled with yellow scales (to be seen only with a magnifying glass), which gives the surface a frosted appearance. *Forewing* with the inner margin paler than the rest of the wing ; the discal white patch anteriorly extended slightly towards the costa, but not reaching it in front of the subcostal nervure. *Hindwing* unmarked. *Antennæ* black, but with a most brilliant glistening white ring at the base of the club. *Head, thorax,* and *abdomen* dark brown, the latter sordid white beneath.

Nearest to *N. albifascia*, Moore, from Burma and Sumatra (doubtfully), and to *N. monteithi,* Wood-Mason and de Nicéville, from Cachar; differs from both in having the white patch of the forewing abruptly ending on the first median nervule, instead of extending below it into the next interspace ; it is also a much smaller insect, and is probably the smallest of the genus hitherto described.

Described from a single female example in Mr. H. J. Elwes' collection obtained by Mr. W. Doherty at Perak in January-February, 1890, and two males and a female also from Perak in my own collection.

26. NOTOCRYPTA SIGNATA, Druce.

Plesioneura signata, Druce, Proc. Zool. Soc. Lond., 1873, p. 360, n. 3, pl. xxxiii, fig. 8; *Notocrypta signata*, de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. iv, p. 191, n. 14 (1889).

HABITAT : Borneo (*Druce*); Victoria point, Lower Tenasserim ; Perak, Malay Peninsula ; Siam ; S.-W. Sumatra ; S.-E. Borneo (*Doherty*).

EXPANSE : 1·33 inches (*Druce*) ; 1·75 (*Druce's figure*) ; 1·95 (*Perak*, ♂, ♀).

DESCRIPTION : "UPPERSIDE, *both wings* dark chocolate-brown. *Forewing* with a large bluish-white oblong spot in the middle, commencing in the cell and extending almost to the anal angle." (*Druce*, l. c.)

Mr. Druce's description given above is so inadequate and the figure of the species so rough (moreover the two do not agree, as the spot in the forewing can hardly be said to extend almost to the anal angle) that it is with some doubt that I have identified the Perak specimens taken by Mr. W. Doherty in January-February, 1890, as the *signata* of Druce, and which I describe more fully as follows:—

MALE. UPPERSIDE, *both wings* and *cilia* deep rich brown (almost fuscous), with a distinct dark purple bloom. *Forewing* with a snow-white lustrous semi-transparent discal patch divided into three parts by the median nervure and first median nervule; glossed (on both surfaces) in some lights with pale violet; the anterior portion extending across the whole width of the cell towards its outer end, the outer edge of this portion concave, the inner edge convex, attenuated anteriorly, so that this portion of the patch is of half the width where it touches the subcostal nervure as it is at the point where it rests on the median nervure; the second portion of the patch is triangular, and occupies the base of the second median interspace; the third portion of the patch is the largest, and reaches from the first median nervule to the submedian nervure, with all its edges evenly rounded except the anterior one resting on the first median nervule. *Hindwing* unmarked. UNDERSIDE, *both wings* dark dull brown, but entirely lacking the purple gloss of the upperside. *Forewing* with the white patch as above; the inner margin paler. *Hindwing* unmarked. *Antennæ* black, the club anteriorly ochreous. *Palpi* black, but the first and second joints with a patch of rich chrome-yellow scales on either side, and a similarly-coloured ring round the eyes. FEMALE. Differs only from the male in the discal band of the *forewing* being narrower, of the same breadth throughout, with quite regular edges.

Described from a single pair of specimens kindly given to me by Mr. H. J. Elwes. Mr. Doherty has given me the numerous localities (given above) for this most beautiful and remarkable species in which he has caught it. He tells me that "It flies with immense rapidity, and rests on the undersides of leaves with wide-spread wings. The wings of the male give off a faint sweet odour." The legs of my solitary male specimen are almost entirely destroyed, but part of one hind leg remains, which bears at the base of the tibia a thick tuft of long ochreous hairs nearly as long as the joint itself. This character, in addition to the habits of the insect being so foreign to that of true *Notocryptas*, forces me to the conclusion that this butterfly is not rightly placed in this genus.

Dr. O. Staudinger, in "Iris," vol. ii, pp. 151-153 (1889), refers to the *Plesioneura signata* of Druce, and according to his identification of the species considers it to be an aberration of *Notocrypta alysos*, Moore, lacking the small white spots beyond the outer discal band of the forewing, usually more or less present in that species. I quite agree with the writer that the presence or absence of these spots is probably of no specific importance whatever in *N. alysos*, but if I have correctly identified *P. signata*, I cannot agree with him as to its being an aberration of *N. alysos*, as almost certainly it is not a true *Notocrypta* at all, but should be placed in another genus.

27. TAPENA LAXMI, de Nicéville, Pl. G, Fig. 28, ♂.

Plesioneura laxmi, de Nicéville, Journ. A. S. B., vol. lvii, pt. 2, p. 290, n. 21, pl. xiii, fig. 5, *female* (1888); *Celœnorrhinus laxmi*, id., Journ. Bomb. Nat. Hist. Soc., vol. iv, p. 186, n. 32 (1889).

HABITAT: Upper Tenasserim; Perak.

EXPANSE: ♂, 1·4 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* dark olive-greenish; an obscure rather broad blackish marginal band. *Forewing* with three subapical spots arranged in a crescent, the upper the largest; a discal macular band consisting of an oblong spot on the costa, a large quadrate spot at the end of the discoidal cell, a small spot at the base of the second median interspace, a larger spot in the middle of the first median interspace, with a minute dot below it in the submedian interspace—all lustrous semi-diaphanous white; an oval black spot towards the base of the submedian interspace; a broad submarginal band of a darker shade than the ground. *Hindwing* with a black spot below the costa towards the base of the wing; two parallel discal series of suffused black spots. UNDERSIDE, *both wings* rather paler than on the upperside. *Forewing* marked as above, but with two dots in the submedian interspace instead of one forming part of the discal macular band, and surrounded with a black ring. *Hindwing* with all the black spots smaller, more compact and better defined than on the upperside. *Cilia, head,* and *body* concolorous with the wings. *Antennæ* with the shaft brown, ochreous below just before the base of the club; the club deep black above, paler below, tip ochreous.

The male differs from the female (previously described erroneously as a male) in its smaller size, darker coloration, smaller spots, especially the uppermost spot of the discal macular band of the forewing, and in having one diaphanous and one black spot only in the submedian interspace instead of two of each, as in the female.

This species evidently belongs to Mr. Moore's genus *Tapena,* the male agreeing very well in outline with the male of the type species of that genus, *T. thwaitesi,* Moore, from Orissa, South India, Ceylon, and Myitta in Burma. In both species, the hind leg of the male is furnished with a very thick tibial bunch of hairs, each one of which is, as seen under a strong lens, strap-shaped, being quite flat, of equal length throughout, and very thin. I have no doubt that "*Celænor-rhinus*" *buchananii,* mihi, also belongs to the genus *Tapena,* and that, now that both sexes of *T. laxmi* are known, it will prove to be quite distinct. It appears to me in the highest degree probable that *T. laxmi* has been described by Mons. Charles Mabille in "La Naturaliste," 1888, p. 98, under the name of *Netrocoryne atilia,* from Minahassa in the island of Celebes. No copy of this periodical is available to me, but I am led to believe that *atilia* and *laxmi* are one and the same species from the description of a local race of the former from Palawan and some other islands of the Philippines, described by Dr. O. Staudinger under the name of *palawana* in "Iris," vol. ii, pp. 157, 165, pl. ii, fig. 11, *male* (1889). Dr. Staudinger's description and figure applies exactly to my *T. laxmi.* As "*Netrocoryne*" *atilia* and "*Plesioneura*" *laxmi* were described in the same year, it may be difficult to ascertain which name has precedence, should the two species prove to be one. Dr. Staudinger very correctly points out that this butterfly cannot be included in the Australian genus *Netrocoryne,* Felder, as that genus has the costa of the forewing of the male folded over as in the Indian genus *Lobocla,* Moore, and many extra-Indian genera.

Described from a single example in the collection of Mr. H. J. Elwes, obtained by Mr. W. Doherty in Perak in the Malay Peninsula, in January or February, 1890.

The "*Plesioneura agni*,* mihi, should also be included in the genus *Tapena*, as the hind leg of the male is furnished with the bunch of hairs typical of the genus. It is found in Sikkim, the Khasi Hills (Rev. Walter A. Hamilton), and the Naga Hills (Mr. W. Doherty, in collection Mr. H. J. Elwes).

28. PARNARA PUGNANS, n. sp., Pl. G, Fig. 30, ♀.

HABITAT: Malay Peninsula; Island of Nias.

EXPANSE: ♂, 1·4 to 1·5, ♀, 1·5 inches.

DESCRIPTION: MALE and FEMALE. UPPERSIDE, *both wings* rich glossy-brown. *Forewing* with eight semi-transparent lustrous ochreous spots, *viz.*, three minute subapical, the posterior the largest; two narrow elongated, separated by the third median nervule only; two in the discoidal cell placed obliquely near its end, the upper the smaller, a mere dot touching the subcostal nervure, the lower three times as large, touching the median nervure; a large spot in a line with these towards the base of the first median interspace; a streak of long hair-like ochreous scales in the basal half of the submedian interspace. *Hindwing* immaculate. UNDERSIDE, *both wings* as above, except that the entire surface of the hindwing, and the costa broadly and the apical half of the forewing are thickly sprinkled with ochreous scales, giving the ground-colour a more yellow appearance than on the upperside. *Cilia* and *antennæ* concolorous with the wings, the club of the latter below ochreous; *body* with long hairs, a little paler than the wings.

In general appearance this species is very similar to *Isoteinon iapis*, mihi (Journ. Bomb. Nat. Hist. Soc., vol. v, p. 213, n. 15, pl. E, fig. 9, *male* (1890), but the male entirely lacks the tuft of long black hairs attached to the inner margin of the forewing and turned underneath and forwards, which is characteristic of the genus *Isoteinon*, as well as the long hairs at the anal angle of the hindwing, which is also a male sexual character in *I. iapis*, being absent in the female. It also markedly differs from that species in having the two spots of the forewing divided by the third median nervule strongly approximated instead of being well separated, and all the spots of a deeper shade of yellow. The name I have given to this species is in allusion to the marked pugilistic nature of the butterflies of this genus. They often have the habit of resting with half expanded wings on the upper surface of a leaf, frequently on or close to its tip, whence they rush forth to do battle with any intruder who closely approaches, especially with another individual of the same species, the two insects circling round each other with immense rapidity, and flying high up into the air. After a while the butterfly is almost certain to return to the same leaf from which it started for its last encounter. Specimens of *Parnaras* are often terribly battered and worn from these frequent aërial fights, and of many species it is often difficult to capture a single specimen fit to put into a collection.

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* *Plesioneura agni*, de Nicéville, Journ. A. S. B., vol. lii, pt. 2, p. 87, n. 32, pl. x, fig. 4, *female* (1883); id., Elwes, Trans. Ent. Soc. Lond., 1888, p. 462, n. 531; *Celænorrhinus agni*, de Nicéville, Journ. Bomb. Nat. Hist. Soc., vol. iv, p. 186, n. 31 (1889).

P. pugnans is described from three male and two female specimens from Perak in the Malay Peninsula obtained by Mr. W. Doherty in January-February, 1890, another male from the same locality sent to me by Mr. W. Davison, and a fourth specimen, also a male, from the Island of Nias taken in 1887 by Mogdiliani, and kindly given to me by Mr. H. J. Elwes, who possesses other specimens in his magnificent collection.

29. PARNARA MIOSTICTA, n. sp., Pl. G, Fig. 31, ♂.

HABITAT : Malay Peninsula.

EXPANSE : ♂, 1·6 inches.

DESCRIPTION : MALE. UPPERSIDE, *both wings* rich dark shining brown; *cilia* ochreous. *Forewing* with two spots in the discoidal cell towards its end, one above the other, the upper a mere dot, the lower somewhat elongated; two subapical dots, and four in a straight line across the disc, commencing with a dot in the lower discoidal interspace, a little larger spot in the upper median, a pyramidal much larger spot in the lower median, and a small spot touching the submedian nervure in the submedian interspace; all these spots semi-transparent (except the last which is opaque) lustrous yellowish. *Hindwing* immaculate save for a minute yellow dot in the middle of the disc answering to a spot on the underside in the first median interspace. UNDERSIDE, *both wings* dark brown, but almost the entire surface overlaid with golden-coloured scales. *Forewing* with the semi-transparent spots as above, but the one in the submedian interspace developed on the underside into a large quadrate pale ochreous patch. *Hindwing* with three minute yellowish dots in the middle of the disc placed one in each interspace outside the discoidal cell between the discoidal and first median nervules, the middle dot the smallest and placed nearer the outer margin than the other two, each dot surrounded by a dark line; one or two very obscure subapical dots. *Antennæ* black, but each joint marked with yellowish beneath, giving it a semi-annulated appearance; club beneath except extreme tip ochreous. Body concolorous with the wings.

In general appearance this species closely resembles *Isoteinon microstictum*, Wood-Mason and de Nicéville (Journ. A. S. B., vol. lv., pt. 2, p. 385, n. 232, pl. xvii, figs. 3, *male;* 3*a*, *female* (1886), from Cachar, but I place it in the genus *Parnara* as it entirely wants the slate-grey setæ attached to the inner margin of the forewing and turned under and upwards over a satiny-ashy patch which is found in that species. The markings of the forewing differ considerably in detail also; in *P. miosticta* there are two well-separated spots in the discoidal cell instead of one geminate spot; the spot in the first median interspace is very much larger and cone-shaped; there is also an additional spot in the submedian interspace. The markings of the hindwing on the underside differ considerably also.

Described from a single male example in Mr. H. J. Elwes' collection captured by Mr. W. Doherty in Perak in January-February, 1890.

30. PARNARA ? MEIKTILA, n. sp., Pl. G, Fig. 32, ♂.

HABITAT: Burma.

EXPANSE: ♂, 1·3 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* glossy pale brown, with almost a golden sheen in some lights. *Forewing* with the base and two-thirds the inner margin clothed with long golden-coloured hair-like scales; an elongated irregular-shaped spot towards the end of the discoidal cell; three increasing conjoined subapical dots; two equal-sized somewhat cone-shaped spots on the disc placed obliquely inwardly, divided by the second median nervule; and a third spot in a line with the two last-mentioned spots placed in the submedian interspace and against the submedian nervure. *Cilia* cinereous. *Hindwing* with a very large tuft of long mane-like black hairs below the costa; the disc of the wing clothed with long golden-coloured hair-like scales, leaving a somewhat broad outer border of the ground-colour. *Cilia* pale ochreous. UNDERSIDE, *both wings* pale ochreous. *Forewing* with the spots of the upperside, the inner margin extending somewhat widely on to the disc, very pale fuscous. *Hindwing* unmarked. *Head, thorax* and *abdomen* above clothed with long golden-yellow hairs, beneath and *legs* pale ochreous, the latter inclined to reddish. *Antennæ* black above, pale ochreous below, the club and tip reddish.

Described from a single example in the collection of Major C. H. E. Adamson, who captured it at Meiktila in Upper Burma, 900 feet above sea level, on 15th February, 1890, and who writes to me that "It was flying on a sandy road, which in the rains becomes a water-course between two hedges." I place this species most doubtfully in the genus *Parnara*, not knowing where better to locate it. The "male-mark" is quite unique in my experience, and this little desert butterfly has no near allies as far as I am aware.

Since the above was written, I have seen two more male specimens of this species in Lieutenant E. Y. Watson's collection, both taken in Burma—one at Poungadaw. They differ from the type specimen in lacking on the upperside of the hindwing the long golden-coloured hair-like scales on the disc; these are probably androconia and being deciduous are often wanting in more or less worn specimens like the ones under notice. On the underside of the same wing also the ground-colour is pale brown, the overlying pale yellow scales seen in the typical specimen have disappeared, leaving a submarginal series of yellowish spots and numerous rather indistinct spots covering the disc. These worn specimens, therefore, have a very different appearance from the freshly-emerged specimen, but they all certainly represent one and the same species. Major C. T. Bingham has also sent me a single male specimen taken in the Ataran Valley, Burma, in February. This is even more aberrant than the two specimens noted above, as it is quite prominently marked with numerous ochreous spots placed upon a dark ground on the underside. The species appears therefore to vary considerably; nevertheless the male can always be distinguished at a glance by the curiously-shaped mark in the discoidal cell of the forewing, and the large patch of black setæ on the upperside of the hindwing below the costa.

I take this opportunity to figure on Plate G, Fig. 29, the type male specimen of *Parnara watsonii,* mihi, described in this Journal, vol. v, p. 223, n. 19 (1890).

31. CHAPRA CÆRE, n. sp., Pl. G, Fig. 33, ♂.

HABITAT: Thaungyin, Burma.

EXPANSE: ♂, 1·8 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* dark brown, with a slight vinous gloss. *Forewing* with eight semi-diaphanous pale yellow spots—two placed inwardly obliquely above one another towards the end of the discoidal cell, three minute subapical, three discal increasing, the uppermost a mere dot; an oblique fine white line across the submedian interspace, this being the typical "male-mark" of the genus. *Cilia* anteriorly brown, posteriorly becoming pale yellowish-cinereous. *Hindwing* immaculate. *Cilia* pale yellow at the anal angle, gradually shading off into brown towards the apex. UNDERSIDE, *forewing* as above, except that the white "male-mark" of the upperside is black. *Hindwing* unmarked. *Head, antennæ,* and *body* dark brown.

There is no species in the genus *Chapra* with which this can be compared, as it differs widely from all those described. It is, however, the "male-mark" being left out of consideration, remarkably and startlingly like several species in the genus *Parnara.* In the forewing it agrees in markings with *P. canaraica,* Moore, but does not possess the two discal white spots on the underside of the hindwing said to be found in that species. *P. austeni,* Moore, is similar in the forewing, except that it has two subapical dots only, the cilia also are said to be cinereous-white. The female of *C. cære* will probably prove difficult to discriminate, owing to its likeness to females of the genus *Parnara.*

Described from a single example collected by Major C. T. Bingham in January, 1891, in the Thaungyin Forests, Burma, and kindly given to me.

32. HALPE HYRIE, n. sp., Pl. G, Fig. 34, ♂.

HABITAT: Naga Hills.

EXPANSE: ♂, 1·4 inches.

Description: Male. Upperside, *both wings* dark shining brown. *Cilia* ochreous, black at the tips of the veins. *Forewing* with five semi-transparent lustrous yellowish spots; two small quadrate equal-sized closely-adjacent subapical spots; a large spot towards the end of the discoidal cell, constricted in the middle, its anterior portion smaller than its posterior portion; a spot in the second median interspace equal in size to the subapical spots; a larger spot in the first median interspace. *Hindwing* unmarked. Underside, *forewing* fuscous, the costa somewhat narrowly, and the apex reddish-ochreous; the spots as above. *Hindwing* reddish-ochreous throughout; a prominent pale yellow small rounded spot below the first subcostal nervule; some very indistinct streaks darker than the ground-colour on the disc between the veins. *Antennæ* black, the tip of the club reddish, the upper portion of the shaft below ochreous. *Body* concolorous with the wings.

This species is perhaps nearest to *H. kumara*, mihi (Journ. A. S. B., vol. liv, pt. 2, p. 121, pl. ii, fig. 10, *male* (1885)), from Sikkim and Bhutan, with which it agrees exactly in the character of the oblique inconspicuous "male-mark" on the upperside of the forewing across the submedian interspace; differing, however, from that species in the much larger size of the spot in the discoidal cell of the forewing, across which the spot in question entirely extends instead of being reduced to a small spot touching the subcostal nervure. There are considerable differences on the underside also, the presence in the hindwing of *H. hyrie* of a prominent subcostal spot being particularly noticeable.

Described from a single male taken by Mr. W. Doherty in the Naga Hills at 5,000—6,000 feet elevation in August—September, 1889, kindly given to me by Mr. H. J. Elwes, who possesses other specimens from the same locality.

33. HALPE ALBIPECTUS, n. sp., Pl. G, Figs. 35, ♂; 36, ♀.

Habitat: Burma.

Expanse: ♂, 1·1 to 1·3; ♀, 1·2 inches.

Description: Male. Upperside, *both wings* dark shining brown. *Forewing* with seven very small translucent diaphanous spots, *viz.*, three conjugated minute dots below the apex, two on the disc in the median interspaces, the lower a little the larger, two towards the end of the discoidal cell placed somewhat inwardly obliquely. *Hindwing* unmarked. UNDERSIDE, *forewing* with the middle dark brown, the costa, outer, and inner margins greyish-ochreous; the spots as above; a submarginal regular series of small pale dots placed one each between the veins; a large oblong pale patch in the submedian interspace; two anteciliary fine black lines; the *cilia* ochreous-grey. *Hindwing* ochreous-grey, the surface bearing numerous dark brown streaks and spots between the veins, and other less conspicuous smaller spots of a pale ochreous colour, the principal of these being a prominent discal series of elongated dark streaks, which is continued in a semi-circle below the costa to the base of the wing; two fine black anteciliary lines, and the *cilia* ochreous-grey as in the forewing. *Body* above concolorous with the wings; first and second joint of the *palpi* and *breast* white, *abdomen* beneath greyish. FEMALE. UPPERSIDE, *both wings* as in the male, but of course lacking the male sexual duplicated tufts of modified scales characteristic of the genus on the upperside of the forewing in the submedian interspace; this "male-mark" in this species being extremely inconspicuous. UNDERSIDE, *both wings* as in the male, but the ground-colour and all the markings paler and more obscure.

This species belongs to the group of *A. beturia*, Hewitson, and appears to be nearest allied to *Baoris? insignis*, Distant (Rhopalocera Malayana, p. 391, n. 1, pl. xxxv, fig. 22 (1886) from Singapore, from which, however, it appears to differ in having all the spots of the forewing smaller, in having three instead of two subapical spots, and in lacking the small subcostal spot above the two spots in the cell; the differences on the underside, too, appear to be considerable.

The type male of this species was taken by Major C. T. Bingham at Thaungyin, Burma, in January, 1891; he has also sent me other two male specimens (which differ from the type in having all the markings of the underside much darker and more prominent) taken in the Ataran Valley, Burma, in February, 1891; another male was taken by Dr. N. Manders on 10th March, 1888, at Mairgyi in the Shan States; the type female was also taken by the same gentleman in Burma—these latter specimens are in Mr. H. J. Elwes' collection, who has kindly lent them to me with several others for description in this paper. I possess two males taken by Major C. T. Bingham in February, 1880 and 1882, one in the Meplay Valley, the other in the Thaungyin Forests.

34. SARANGESA SATI, n. sp., Pl. G, Fig. 37, ♂.

Habitat: Kutch; Rajputana.

Expanse: ·95 of an inch.

Description: Male. Upperside, *both wings* shining fuscous. *Cilia* long, fuscous, prominently marked with seven pale ochreous spots in the forewing and six in the hindwing. *Forewing* sprinkled with very minute white spots. *Hindwing* dusted with greyish speckles. Underside, *both wings* paler than above, marked with numerous minute whitish spots. *Forewing* with a spot at the end of the discoidal cell and one above it; three subapical spots, two below these on the disc divided by the first median nervule; a very irregular submarginal series consisting of about nine spots. *Hindwing* covered evenly throughout with small spots.

This genus has hitherto consisted of three species—*S. purendra* Moore, *S. dasahara*, Moore, and *S. albicilia*, Moore—from all of which *S. sati* may be known by its much smaller size, the minuteness of all the spots on both surfaces, and the strongly and regularly checkered cilia. It is a very distinct species, and appears to be confined to a well-defined desert region.

Described from two examples from Kutch—one in Mr. H. J. Elwes', and one in my own collection, and a third specimen, also in my collection, from Deesa in Rajputana, the last of which is the type.

35. ISMA INARIME, n. sp., Pl. G, Fig. 38, ♂.

Habitat: Perak.

Expanse: ♂, 1·3 inches.

Description: Male. Upperside, *both wings* dark brown strongly glossed with vinous in some lights. *Forewing* with seven lustrous semi-transparent white spots, *viz.* :— two elongated spots placed inwardly obliquely towards the end of the discoidal cell, the upper rather the smaller; two conjoined subapical, the lower rather the larger; another spot equal in size to the posterior of the subapcial spots in the lower discoidal interspace; a large cone-shaped spot at the base of the second median interspace; a very large quadrate spot towards the base of the first median interspace; an eighth opaque quadrate spot about coequal to the spot in the second median interspace in the middle of the submedian interspace and lying against that nervure; *cilia* anteriorly cinereous, posteriorly becoming faintly tinged with yellow. *Hindwing* with a dot in the cell and three spots placed around the cell all semi-transparent lustrous white, the one in the first median interspace the largest and very elongated, the one in the second median interspace also elongated but much smaller, the one in the discoidal interspace a mere dot; *cilia* very pale yellow. UNDERSIDE, *forewing* dark brown, the costa somewhat broadly and the apex widely thickly sprinkled with golden-coloured scales; the opaque spot in the submedian interspace on the upperside developed into a large ill-defined diffused patch below; the other spots as above. *Hindwing* golden-yellow throughout; the spots as above, but more or less outwardly defined by a very fine dark brown line; an additional dot in the lower subcostal interspace. *Body* above dark brown, below yellow. *Antennæ* above black; below becoming more and more marked with ochreous till the club is reached, this being entirely ochreous except the tip.

This species is evidently closely allied to *Isma bononia*, Hewitson, from Singapore (figured in Distant's "Rhopalocera Malayana," p. 386, n. 2, pl. xxxv, fig. 20 (1886)), but differs in having an additional spot in the discoidal cell of the forewing and one in the hindwing, all the spots, to judge from the figure, being much smaller in *I. bononia* than in *I. inarime*.

Described from a single example in Mr. H. J. Elwes' collection taken in January—February, 1890, by Mr. W. Doherty in Perak in the Malay Peninsula.

36. TAGIADES TRIPURA, n. sp., Pl. G, Fig. 39, ♀.

HABITAT: Perak.

EXPANSE: ♀, 1·2 inches.

DESCRIPTION: FEMALE. UPPERSIDE, *both wings* shining fuscous. *Forewing* unmarked; *cilia* fuscous. *Hindwing* bearing two large pure white triangular patches towards the anal angle; cilia anteriorly fuscous, posteriorly pure white. UNDERSIDE, *forewing* fuscous, the apex and inner angle sparsely sprinkled with white scales.

Hindwing pure white, the costa, apex and abdominal margin narrowly fuscous; a small fuscous spot at the apex of the discoidal cell, another of the same size near the middle of the first median interspace, and a much larger one in the middle of the submedian interspace. *Head* and *thorax* above fuscous, *abdomen* anteriorly fuscous, but the four or five posterior segments, as well as the extreme tip, ringed with pure white; *body* beneath grey.

Near to *T. minuta*, Moore (Lep. Cey., vol. i, p. 176, pl. lxviii, figs. 4, 4*a* (1881)), from which it may at once be known by the large white patches on the upperside of the hindwing and the terminal segments of the abdomen being ringed with white. It is evidently allied also to the *Heteropterus ?* (*Steropes*) *scopas* of Staudinger ("Iris," vol. ii, p. 161, pl. ii, fig. 12, *male* (1889)), from Palawan, from which it may be known on the upperside by not possessing three considerable-sized spots placed in the form of a triangle on the middle of the disc; the hindwing also in *H. ? scopas* does not appear to be blotched with white; on the underside the hindwing is a good deal like *T. tripura*, but the latter lacks the black marginal spots present in *H. ? scopas*. Furthermore, *T. tripura* is even more closely allied to the *Heteropterus ? catoleucos*, also of Dr. Staudinger, from Palawan (l. c., p. 162, pl. ii, fig. 13, *male* (1889)), but lacks the one (or two) subapical spots present in the forewing of that species, and the white area of the hindwing is far less extensive on both surfaces, but especially so on the underside.

With regard to the genus *Steropes*, Boisduval, used by Dr. Staudinger for one of the two species above referred to, it cannot be used for *Lepidoptera* as it is preoccupied in *Coleoptera*. The type of the genus *Heteropterus*, Dumeril, is *morpheus*, Pallas, which occurs in Europe and Northern Asia, and can have, I think, nothing in common generically with *minuta*, *scopas*, *catoleucos*, and *tripura*. For the present all these species had better, perhaps, remain in the genus *Tagiades*, in which Mr. Moore has placed *minuta*, the first-described of this group.

Described from a single example in Mr. H. J. Elwes' collection captured by Mr. W. Doherty in the Perak State, Malay Peninsula, in January-February, 1890.

37. ABARATHA ALIDA, n. sp., Pl. G, Fig. 40, ♂.

HABITAT: Tilin Yaw, Upper Burma.

EXPANSE: ♂, 1·55 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* dull pale ochreous-brown. *Cilia* white, inwardly defined by a fine dark line, and prominently spotted with darker at the ends of the veins. *Forewing* with a small round white transparent spot about the middle of the discoidal cell, outwardly defined with black; an irregularly-shaped similar spot at the end of the cell; three conjoined subapical spots, the middle one the largest; two minute dots below these, placed inwardly obliquely, divided by the lower discoidal nervule; below these again are four more spots, the first (uppermost), third and fourth equal-sized, small, the second much the largest, the first is placed in the second median interspace, the second in the first median interspace, the third and fourth in the submedian interspace; immediately beyond the above-described nine spots which completely cross the disc is an indistinct series of nine small dark lunules placed one each outwardly against each of the spots. *Hindwing* practically unmarked, though there are traces of darkish spots on the disc. UNDERSIDE, *both wings* thickly overlaid with large pure white scales, so that the dark ground-colour is entirely hidden except narrowly along the outer margins, the whole wing-surface having the appearance of being thickly strewn with hoar-frost. *Forewing* with the eleven transparent white spots as on the upperside. *Hindwing* unmarked. *Head, thorax,* and *abdomen* above and beneath concolorous with the wings. *Legs* white, the foreleg with the usual long tuft of deep black hairs attached to the coxa. *Antennæ* blackish, the shaft finely ringed with ochreous, the club beneath ochreous.

A. alida has the spots on the forewing practially the same as in *A. ransonnetii*, Felder, and *A. taylorii*, mihi, but smaller; but it differs in the tone of the coloration of the upperside, the former being very dark brown with a good deal of ochreous, while the latter is almost entirely ochreous; the underside of *A. alida* is, however, conspicuously different from either, being frosted with white throughout except very narrowly along the outer margins of both wings.

Described from a single male example captured at Tilin Yaw, Upper

Burma, on 10th March, 1890, by Lieutenant E. Y. Watson, in whose collection it is deposited.

Genus SANCUS, nov.

MALE and FEMALE. FOREWING, elongated, narrow; *costa* strongly arched at base, then almost straight to apex; *apex* rather acute; *outer margin* convex; *inner* margin slightly convex in the male, slightly concave in the female; *costal nervure* not reaching to opposite the apex of the discoidal cell; *first subcostal nervule* given off at about the middle of the discoidal cell, strongly deflected upwards soon after its origin, and touching the costal nervure for a little distance, ending on the costa about opposite to the apex of the cell; *second* subcostal originating a little nearer to the base of the third than to the base of the first subcostal; *fourth* subcostal originating half as near to the base of the third as that nervule originates from the base of the second, terminating at the apex of the wing; *subcostal nervure* terminating on the outer margin well below the apex; *discoidal cell* narrow, long, extending considerably beyond the middle of the wing; *upper disco-cellular nervule* short, strongly outwardly oblique; *middle* and *lower* disco-cellulars straight, strongly inwardly oblique, the middle a little longer than the lower; *median nervules* originating at nearly equal distances apart, the *second* long before the lower end of the cell, the *first* at about the middle of the cell; *submedian nervure* slightly sinuous. "MALE with a curious impressed elongated oval brand placed so immediately behind as to touch the median nervure, and extending for one-third of its length along the first median nervule" on the underside of the wing. *Hindwing* with the *costal*, *outer*, and *abdominal margins* strongly arched; *costal nervure* long, curved; *first subcostal nervule* originating a little before the apex of the discoidal cell; *discoidal cell* broad, rather short, not quite reaching to the middle of the wing; *upper disco-cellular nervule* straight, inwardly oblique; *lower* disco-cellular also straight, equal in length to the upper disco-cellular, outwardly oblique; *discoidal* nervule obsolete, can barely be traced; *second median* nervule originating a little before the lower end of the cell; *first* originating twice as far from second, as second is from third; *submedian nervure* straight; *internal* nervure straight. Type, the "*Astictopterus*" *subfasciatus*, Moore.

The structure of the type species of this genus is very curious; the forewing is much elongated, the hindwing is ovate; in coloration it resembles several species of the old genus *Astictopterus* (such as *diocles*, Moore, *olivascens*, Moore, *butleri*, Wood-Mason and de Nicéville), but according to Mr. Distant, differs widely in structure from that genus as restricted by him in that the second median nervule of the forewing originates at about the same distance from the base of the first as from the base of the third, instead of being about twice as far apart from that of the first as from the third. It agrees, however, with the type species of *Astictopterus* (*jama*, Felder, from the Malay Peninsula, Sumatra, Java, and Bantam) according to Mr. Distant, in that the first subcostal nervule of the forewing originates about opposite to the base of the first median nervule. The type species of *Sancus* is quite unique amongst *Hesperiidæ* as far as I am aware in having the first subcostal nervule of the forewing touching the costal nervure for a short distance, and in the position and shape of the "male-mark," which is composed of a very dense mass of androconia. I am unable to give a detailed comparison between *Sancus* and *Astictopterus*, as I have not seen the type species of the latter genus, nor does Mr. Distant give a detailed diagnosis of it in his "Rhopalocera Malayana."

38. (1). SANCUS SUBFASCIATUS, Moore.

Astictopterus subfasciatus, Moore, Proc. Zool. Soc. Lond., 1878, p. 842; id., Wood-Mason and de Nicéville, Journ. A. S. B., vol. lv, pt. 2, p. 380, n. 204, pl. xviii, figs. 1, 1 *a*, *male* (1886); id., Hampson, l. c., vol. lvii, pt. 2, p. 365, n. 223 (1888); *Tagiades pulligo*, Mabille, Ann. Soc. Ent. France, fifth series, vol. vi, p. 272, n. 20, Bulletin, p. xxvi. n. 20 (1876); *Astictopterus ulunda*, Plötz, MS.; *Astictopterus* (*Psolos*) *ulunda*, Plötz (*pulligo*, Mabille), Staudinger, Iris, vol. ii, p. 147 (1889).

Habitat: Ahsown in Upper Tenasserim; South India (*Moore*); Silcuri in Cachar (*Wood-Mason* and *de Nicéville*); western slopes of the Nilgiris, 500—3,000 feet (*Hampson*); Malacca; Java (*Mabille*); Palawan; Java; Jolo, Sulu Islands (*Staudinger*); Modah, Upper Burma (*Butler*); Wynaad in South India; Cachar; Upper Tenasserim (*coll. Indian Museum*); Nilgiri Hills; Sibsagar in Upper Assam; Akyab, Rangoon, Henzada, Dawnat Range, all in Burma; Perak in the Malay Peninsula; Borneo (*coll. de Nicéville*).

I have experienced much difficulty with regard to the synonymy of this species, and though I have written to Dr. O. Staudinger, M. Charles Mabille, and Herr P. C. T. Snellen with regard to certain species described by them and allied to or synonymous with the type species of the genus *Sancus*, a specimen of which I sent to each of these gentlemen, I am still unable to give the synonymy with any certainty. Dr. Staudinger writes to me that *subfasciatus*, Moore, is certainly the same as *Astictopterus* (*Psolos*) *ulunda*, Plötz, and *Tagiades pulligo*, Mabille, as given by him (Dr. Staudinger) in his paper on the Butterflies of Palawan in "Iris," vol. ii, p. 147 (1889). The name "*ulunda*" appears to be a MS. one, which I have been unable to trace either in any of the late Herr Plötz's papers or in the Record of Zoological Literature. The genus "*Psolos*" of Mabille also seems never to have been described, and I am unaware what species M. Mabille takes as the type.

Judging from the figure of *Tagiades ? fuscula*, Snellen, Tijd. voor Ent., vol. xxi, p. 42, n. 183, pl. ii, fig. 3 (1878), from Bonthain, Bantimoerong, Mangkasar, all in South-Western Celebes, I thought that that species also was synonymous with *subfasciatus*. Heer Snellen writes to me that he does not think that this is so, as *fuscula* is a "long-winged" species. But it appears to me that this elongation of the wings is one of the most marked characteristics of *subfasciatus*. Heer Snellen tells me distinctly that while *pulligo* has the curious "male-mark" characteristic of *subfasciatus*, *fuscula* lacks it entirely; and, moreover, that Staudinger's *celunda* from Celebes [Iris, vol. ii, p. 146 (1889)] is a synonym of the *T. ? fuscula*, Snellen, from the same island. But to complicate matters still further, Dr. Staudinger distinctly states that the characteristic male-mark of my genus *Sancus* is found in *celunda*, while Heer Snellen says it is not present in the male of *fuscula*. How, therefore, can the two species be the same, as Heer Snellen considers them to be?

EXPLANATION OF THE PLATES.

PLATE F.

Fig. 1. *Mycalesis* (*Myctilus*) *mystes*, n. sp., ♂, dry-season form, p. 343
" 2. " " " " " wet- " " p. 344.
" 3. *Clerome kirata*, n. sp., ♂, p. 344.
" 4. *Argynnis mackinnonii*, n. sp., ♂, p. 346.
" 5. " " " ♀, p. 346.
" 6. *Neptis nar*, n. sp., ♀, p. 349.

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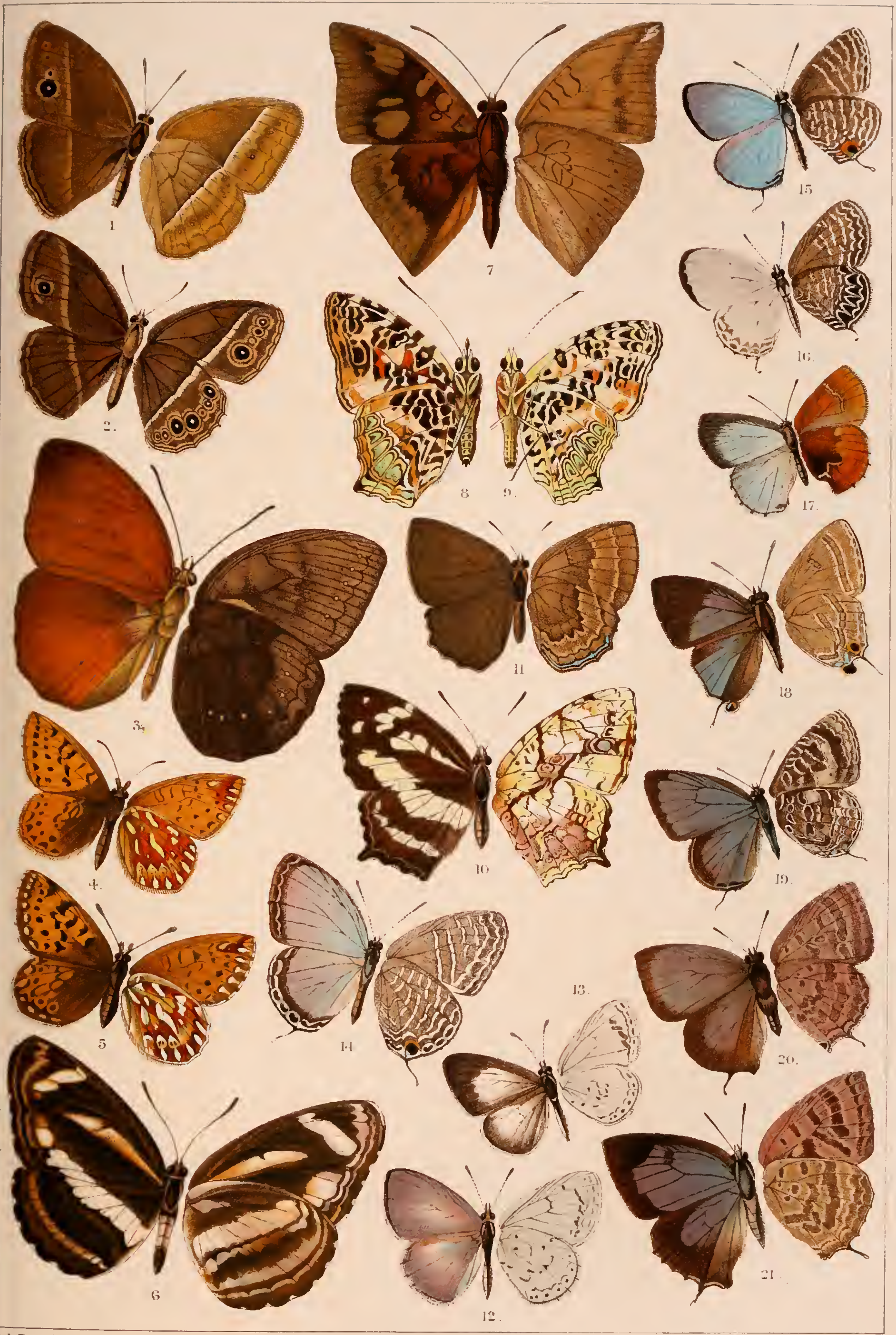
Fig. 7. *Euthalia eriphylæ*, n. sp., ♂, p. 353.
,, 8. *Symbrenthia hypselis*, Godart, ♂, p. 356.
,, 9. ,, *sinis*, n. sp., ♂, p. 357.
,, 10. ,, *hippoclus*, Cramer, ♀, p. 354.
,, 11. *Simiskina pharyge*, Hewitson, ♀, p. 361.
,, 12. *Cyaniris coalita*, n. sp., ♂, p. 363.
,, 13. ,, ,, ,, ♀, p. 363.
,, 14. *Lampides latimargus*, Snellen, ♂, p. 364.
,, 15. ,, *bochides*, n. sp., ♂, p. 367.
,, 16. ,, *philatus*, Snellen, ♂, p. 368.
,, 17. *Satsuma* sp., ♀, p. 374.
,, 18. *Rapala refulgens*, n. sp., ♂, p. 376.
,, 19. *Acesina arisba*, n. sp., ♂, p. 369.
,, 20. *Arhopala alemon*, n. sp., ♂, p. 371.
,, 21. ,, ,, ,, ♀, p. 371.

PLATE G.

Fig. 22. *Arhopala basiviridis*, n. sp., ♂, p. 373.
,, 23. ,, *amatrix*, n. sp., ♂, p. 370.
,, 24. ,, ,, ,, ♀, p. 370.
,, 25. *Calliana pieridoides*, Moore, ♀, p. 377.
,, 26. *Celænorrhinus clitus*, n. sp., ♂, p. 378.
,, 27. *Notocrypta neæra*, n. sp., ♀, p. 379.
,, 28. *Tapena laxmi*, de N., ♂, p. 382.
,, 29. *Parnara watsonii*, de N., ♂, p. 388.
,, 30. ,, *pugnans*, n. sp., ♀, p. 384.
,, 31. ,, *miosticta*, n. sp., ♂, p. 385.
,, 32. ,, *? meiktila*, n. sp., ♂, p. 386.
,, 33. *Chapra cœre*, n. sp., ♂, p. 388.
,, 34. *Halpe hyrie*, n. sp., ♂, p. 388.
,, 35. ,, *albipectus*, n. sp., ♂, p. 389.
,, 36. ,, ,, ,, ♀, p. 389.
,, 37. *Sarangesa sati*, n. sp., ♂, p. 391.
,, 38. *Isma inarime*, n. sp., ♂, p. 391.
,, 39. *Tagiades tripura*, n. sp., ♀, p. 392.
,, 40. *Abaratha alida*, n. sp., ♂, p. 394.

L. DE NICÉVILLE, Journ. Bomb. Nat. Hist. Soc. Pl. F.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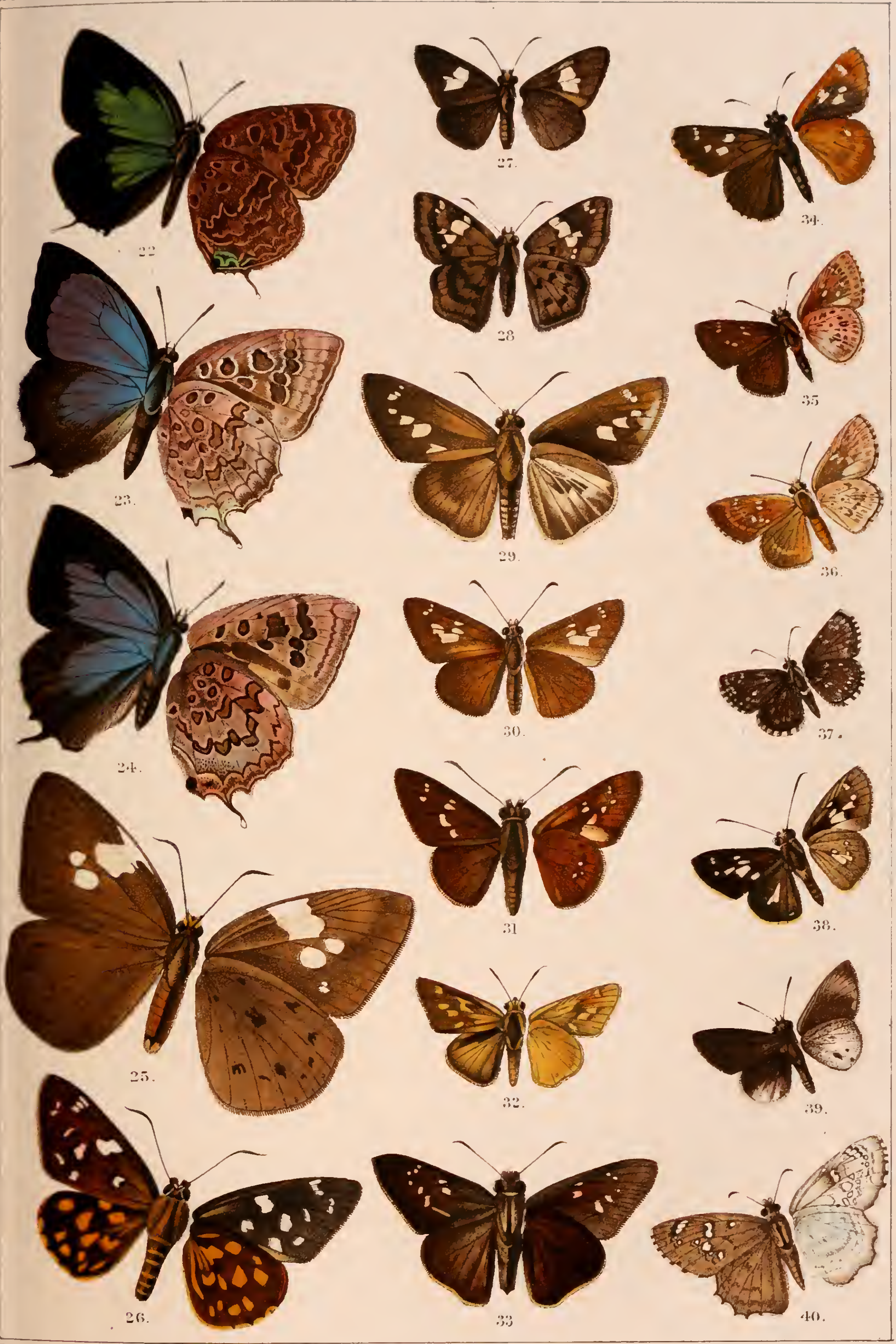
INDO-MALAYAN BUTTERFLIES.

L DE NICÉVILLE, Journ. Bomb. Nat. Hist. Soc. Pl. G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INDO-MALAYAN BUTTERFLIES.

SUBSTANCES USED AS INCENSE IN THE EAST.

By W. Dymock, Brigade-Surgeon, Retired.

(*Read before the Bombay Natural History Society on* 1*st July,* 1891.)

Incensation or sacrifice is the chief element of all the ancient religions, and the most primitive form of it was the sacrifice of human beings; children offered to Moloch or Baal, captives burnt by the ancient Greeks and Gauls, the Merieh sacrifice of the Khonds, and the sacrificial cakes of Peru soaked in human blood. Primitive man offered what he thought would be most acceptable to his deity, in a more civilized condition he substituted burnt offerings of animals for human sacrifices; to these he added perfumes, and lastly the fire and perfumes only remained as the symbol of sacrifice.

In the Book of Genesis (8, 20) we are distinctly told that burnt offerings of animals were made, and that "the Lord smelled a sweet savour." In Exodus (30, 34) Moses is directed to take sweet spices stacte, onycha, and galbanum, with pure frankincense for use as incense in the tabernacle. In India, animal incense, in the form of *ghi* or clarified butter, is still used by the Hindus in the *Hôm* sacrifice, and in the *arthi* or incensation of idols and important personages, such as the bridegroom by the bride.

Incense burning is all that remains as a symbol of sacrifice in the Christian Church, and is used at the daily sacrifice of the Eucharist. Among the Parsees fire is considered to be the son of Hormuzd, and to act as a mediator between the faithful and the divine being. Sacrifices of bread, meat, and the juice of the *Homa* plant are made.

Among the ancient Arabs fire alone appears to have been used in sacrifice, and also fire upon which salt was sprinkled.

What was the practice of these two ancient nations in pre-historic times we do not know, but we may infer that it was similar to that of uncivilized man elsewhere.

The principal plants which furnish the incenses used in the East are: —

Ailantus malabarica, D. C., which yields the *Baga-dhup* incense of Canara.

Boswellia, several species growing in Arabia and Africa which yield *Olibanum* or *Frankincense.*

Boswellia serrata, Roxb., growing in India and yielding the *Guggalu* of Sanskrit writers.

Aquilaria Agallocha, Roxb., and *A. moluccana,* Lamk., yielding *Aloes* or *Eagle-wood.*

Styrax Benzoin, Dryander, yielding *Benzoin* or *Benjamin.*

Styrax officinalis, Linn., yielding the bark sold as *Usturak* in the bazars.

Liquidamber orientalis, Miller, yielding *Liquid storax,* the *Śilaras* of the bazars.

Dorema Ammoniacum, Don, yielding the root sold as *Boi* in the bazars.

Saussurea Lappa, Clarke, yielding *Costus* or *Kust,* best known in Bombay as *Upalet.*

Santalum album, Linn., yielding *Sandal-wood.*

Laurus Camphora, Linn., yielding *Camphor.*

Dryobalanops Aromatica, Gärtn., yielding *Borneo camphor,* the *Barás* or *Bhimseni-kápur* of the bazars.

Cinnamomum, several species, yielding *Cassia* and *Cinnamon.*

Cedrus Deodara, Lond., yielding the *Deodár-wood* of the bazars.

Pinus longifolia, Roxb., yielding *Sarala-drava.*

Jurinea macrocephala, Benth., yielding a root which is used as incense under the name of *Dhupa* at Rampur and elsewhere in Northern India.

Juniperus communis, Linn., *J. recurva,* Ham., and *J. macropoda,* Boiss., yielding *Juniper-wood* and *resin,* used as *Dhupa* in Northern India.

Cupressus torulosa, Don, the Himalayan Cypress, the wood and resin of which is burnt as incense in the Hindu temples of the North.

Morina Coulteriana, Royle, which furnishes a root used as incense in Kashmir.

Balsamodendron, several species, yielding *Myrrh* and *Bdellium.*

Shorea robusta, Gärtn., yielding the *Rála* or *Dhuna* of the bazars.

Shorea Talura, Roxb., yielding the *Sambráni* incense of the Wynaad.

Canarium bengalense, Roxb., yielding the *Gokaldhup* incense of the Lepchas in Sikkim.

Vateria indica, Linn., yielding the *Vellai-kingiliyam* incense of Southern India.

Ferula galbaniflua, Boiss. et Buhse, yielding *Galbanum* used as incense by the Jews.

The *Baga-dhup* of Canara is a fragrant resin of the colour of the glass used for making Hock bottles, it is used in Malabar by the Saraswat Brahmins as a substitute for the *Sarala* or oleo-resin of the Himalayan *Pinus longifolia.*

It is hardly necessary to say much about frankincense as it is so well known, but it is curious that the botanical source of a substance, which is one of the oldest articles of commerce, has only been ascertained within the last 50 years. The Book of Exodus, and the recent discoveries of Prof. Dümichen of Strassbourg in the temple of Dayr el Behri in Upper Egypt, shew that it was a well known article of commerce 1700 years before the Christian era, and one of the inscriptions at the temple states that thirty-one of the trees producing it were brought to Egypt from the land of Punt (the Somali coast) as an offering to the god Ammon. The name which frankincense bears in the East is of Semitic origin and signifies "milk," from the juice being milky when it first exudes from the tree; in Hebrew it is *Lebonah* and in Arabic *Luban,* the latter word being in use among the Musalmans of India. The Hindus call it *Visesha.* Formerly this gum-resin was supposed to be obtained from a kind of Juniper, until Colebrooke in the 11th Vol. of the *Asiatic Researches* described the *Boswellia serrata* of Roxburgh growing in India, and erroneously supposed that he had discovered the source of the commercial article. This mistake was not corrected until Carter, in 1846, brought specimens of the true *Olibanum* plant from Ras Fartak on the S.-E. coast of Arabia (*Journ., By. Br., Rl. As. Soc.,* II. (1848, 380) tab. 23). Lastly Birdwood, in a monograph (1870), described some specimens of the *Olibanum* tree from the African coast, also Carter's plant which was still growing in Bombay (*Linn. Trans.,* XXVII. 111-148).

It is probable that this incense was brought to India in pre-historic times by Arab traders, and we know that Alexander, B. C. 325, found a vessel loaded with it at the mouth of the Indus. The bark of the frankincense tree, called by the Arabs *Kishar–kundar* or *Kashfa,* forms a separate article of trade, which is known in India as

Dhupa or incense. Frankincense is more generally used than any other kind of incense, and together with benzoin, storax, myrrh, and *cascarilla* bark forms the incense now in use in Europe.

The exudation of the Indian *olibanum* tree appears to have been formerly used in this country, under the name of *Guggalu,* as an incense to a considerable extent; but, owing to the facilities for communication which are now afforded, it has been ousted by the commercial article, and is no longer collected. It differs from true olibanum in containing a much larger proportion of gum, and therefore does not burn so well, and is less fragrant. When collected by cutting the trees in the cold weather, it is a semi-fluid substance like Canada-balsam, but the specimen I now show of the natural exudation collected in May last bears a considerable resemblance to commercial olibanum of inferior quality.

Aloe or Eagle wood.—The use of this precious wood as a perfume and incense is of great antiquity. Together with myrrh, cassia, and other products of the East it is mentioned in the sacred writings of the Jews (Num., xxiv. 6; Psalms, xlv. 8; Prov. vii. 17; Cantic. iv. 14) under the name of *Ahalot* or *Ahalim.* It is the *Agallochon* of the ancient Greeks which is described by Dioscorides as a wood brought from India and Arabia. Later writers from Ætius' time call it *Zulaloe* or "aloe wood," the name by which it is still known in Europe. The same substance is the *Agaru* of the Hindus, the *Garu* of the Malays, and the *Chin-heang* of the Chinese. In Sanskrit medical works it bears the synonyms of *Rájárha,* "worthy of a prince"; *Visva-rupa,* "taking all forms"; *Krimi-ja,* "produced by worms"; *Anarya-ja,* "produced in a non-aryan country"; *Kanaka,* "golden"; *Kaliya,* "black," &c. As aloe wood bears the Sanskrit name of *Anarya-ja,* it is probable that it was used by the aborigines of Eastern Asia before it became known to the Hindus, but that at a very early date it was carried overland to Central Asia, India, and Persia, and from thence reached Arabia and Europe. The early Arab travellers appear to have collected a good deal of information concerning the commerce and sources of supply of the wood. Yohanna bin Serapion mentions four kinds—*Hindi, Mandali, Sainfi,* and *Kamári;* and Ibn Sina, after enumerating a number of varieties of the commercial article, remarks, "the tree is said to be buried to promote the formation of aloe wood." This we now know to be correct. Ibn Batuta speaks of *Kamári* aloe wood as soft like wax. Abu Zaid calls it *Kámaráni,* and says it is the best kind. Abulfeda states that *Ood* comes from the Kamarun mountains. The Kamarun of the Arabs is what we know as Cape Comorin, which they considered to divide the country and seas of India from the country and seas of China. The former region was also called by them *Belád-el-fulful* or *filfil,* "the pepper country," and the latter *Belád-el-nár,* "the fire or incense country." Other names applied to different qualities of aloe wood were *Kákuli* or *Jawi,* "coming from Java or from Kakuleh," a place in Java; *Saimúri,* "coming from Saimur or Samar," an island in the Eastern Archipelago; and *Mawardi,* "smelling like rose water." The term Sinfi or Sainfi is probably derived from Champa, a province in Cambodia, and Mandali from Mount Mandar or Mandal, south of the modern town of Bhagalpur. Haji Zein el Attar (1368) calls aloe wood *Ood-el-juj,* from Juj or Juju, the name of a town in Cathay. After translating Ibn Sina's article on Ood, he gives his own opinion in the following terms:—"The author of this work (Ikhtiarát) says the best is called *Kalambak* and comes from the port of Jena, which is ten days' sail from Java. It is sold for its weight in gold. You would think it odourless, but when warmed in the hand it has a very sweet persistent odour; when burnt the odour is uniformly sweet until the wood is consumed. Next is *Mandali* and *Samanduri,* both from Sofala in India. The best of these is of a golden colour and heavy. *Kakuli* is like the Indian, and is generally in large pieces marked with black and yellow lines; then there is *Kamári,* golden brown, without streaks; it comes from the Kamarun country, and *Sainfi* from Samf, it is hard and sweet; then *Sakáli* and *Afási,* a moist kind from China; then *Mantai, Randi, Halai,* and *Laufi,* all of about equal value. And in Manta (Southern China) there is a tribe who call the wood *Ashbáh,* and it is of two kinds: one of these is in large pieces weighing from 5 to 50 maunds, without much odour, and used for making combs, knife-handles, &c. It must not be supposed that all these names indicate so many varieties of wood; they appear to have been simply trade terms originating from accidental circumstances: for instance, it appears that the name *Halai* arose from the wood being brought to the West over the Hala mountains in Sind by Multani merchants."

Rumphius describes two kinds of true and two of false aloe wood. The first kind of true aloe wood, he says, is called *Kilam* or *Ho-kilam* by the Chinese and *Calambac* by the Malays, and is produced by a tree growing in the provinces of Champa and Coinam, and in Cochin China. (This tree has been described by Loureiro under the name of *Aloexylon Agallochum,* but it is unknown to modern botanists.) The second kind, called *Garo,* is the product of *A. malaccensis,* Lamk., which he figures: this is the Chin-heang of the *Pun-tsaou-kong-muh,* or great Chinese Herbal.

Modern investigation has shown that aloe wood (a corruption of the Arabic *Al-aod,* or "*the wood par excellence*"), is obtained from two species of *Aquilaria* growing in Sylhet and extending, through Manipur, Chittagong and Arakan, to Mergui and Sumatra. It first reached Europe through China and Northern Asia or through India, but when the early Arab navigators found their way to China, the route was gradually changed. The collection of the wood in Sylhet, where the tree was found by Roxburgh, has been described, and confirms much of what has been said by the early Mahometan writers above quoted. It appears that the trees are felled, and afterwards searched to find the pieces of dark-coloured resinous *agar* which occur here and there in the naturally soft white wood of the trunk and branches. The blackest and heaviest portion, which is known as *gharki,* because it sinks in water, is worth in Sylhet from six to eight rupees per pound. From the specimens on the table you will see how very limited the resinous infiltration often is.

At the present day aloe wood is imported into Bombay from Bankok, usually *viâ* Singapore or Batavia. Some of the Parsee silk-merchants also import it from Hong-kong. Only two kinds are known—*Máwardi* and *Gáguli;* the first appears to be the produce of *A. malaccensis,* and the second that of the Indian *A. Agallocha.*

There are several kinds of false aloe wood in the market; the most important of these is *Taggar,* a wood from Africa or Madagascar, of which I show you a specimen.

Aloe wood is now hardly known in Europe, but in former times the most expensive perfumes were sought for to be used as incense

Pliny animadverts strongly (Books 12 and 13) upon the extravagance of the Romans in this respect, especially at funerals, and contrasts it with the simplicity of the Greeks at the time of the Trojan War, when incense was not used in sacrificing to the gods, but only the indigenous juniper and citrus wood necessary to burn the animals.

Benzoin, the *Luban-Jawi,* or Java frankincense of the Arabs, which they began to bring from the *Belád-el-nár,* or "incense country," about the middle of the fourteenth century, was not known to the ancient Hindus or to the inhabitants of Europe; but they used a somewhat similar substance obtained from *Styrax officinalis,* which is now no longer an article of commerce, though the bark is still used as incense, and appears occasionally in the Indian bazars under the name of *Usturak.* Benzoin appears to have rapidly gained the favour of the users of incense both in the East and in the West. It is used all over India. Bombay imports annually about 6,000 cwts., and large quantities go to Europe, where it is used as an ingredient of the incenses used in the Greek and Roman churches. The modern storax of commerce was introduced in the sixth century apparently to replace the original storax, the source of supply of which had become insufficient to meet the demands of commerce, which were very considerable both in Europe and in the East. We learn from the author of the "Periplus of the Erythrean Sea" that as long ago as the first century, *Silhaka* (storax) was exported to India, and about this time it is mentioned as one of the imports of Thana, on the Western Coast. The Arabs also carried it to China, and it appears to have been known in the Indian vernaculars as *Ast-lobán,* "Western frankincense." Upon the decline of the port of Thana the trade was transferred to Surat, then to Goa, and afterwards to Bombay, which still imports from 300 to 400 cwts. yearly. Storax is an ingredient in European incense. In the trade statistics of the early European traders in India it is called *Rosa Mallas* and *Rose Malloes,* a name which it still retains, and the origin of which is doubtful, though some suppose it to be derived from *Rosamála,* the Malay name for *Altingia excelsa,* a tree which produces an odoriferous resin in Java and Burma. That the latter supposition is incorrect I think there can be little doubt, as the only *Rose Malloes* known in Bombay is the European storax;

the name appears to have been applied to it incorrectly through a confusion of this substance with the honey or manna collected from trees, the δρσσόμελι of the Greeks, and the *Ros melleus* of the middle ages. The author of the Makhzan-el-Adwiya says :—" *Rasimilius* is a Greek name for a kind of incense called in Arabic *Dukhan-el-daru* and in Hindi *Ast lobán*. In another place, speaking of *Daru,* he says that its Greek name is *Fazugus. Zugos* (ζυγος) is the modern Greek for the storax tree (*Liquidamber orientalis*).

Ammoniacum root, the *Boi* of the Parsees, is regularly imported into Bombay for use in Parsee ritual as an incense. It is popularly spoken of as a wood, and is traditionally understood to be one of the fragrant woods mentioned in the Avesta. It is remarkable that before Persian ammoniacum was known in the west, the gum-resin of an Ammoniacum plant growing about Cyrene in Libya and in the neighbourhood of the temple of Ammon was used as an incense under the name of *Thus Libycum,* or "Libyan frankincense." The use of this substance appears to be now entirely confined to the Parsees.

Costus was one of the fragrant substances which the Arabs obtained from the Hindus and introduced into Europe to satisfy the ancient demand for perfumes to be burnt upon the altars of the gods and at funerals. They themselves considered it to be *the best of perfumes for fumigation.* The Hindus and Chinese used this root for smoking as a narcotic before opium was known in the East, and it is still exported to China in enormous quantities, to be used as an incense. Baden-Powell says :—" In every Hong it is found; no mandarin will give an audience until the *patchak* incense smokes before him; in every Joss-house it smoulders before the Tri-budh deity; in every floating junk in the Chinese rivers, the only home of countless hordes, Budh's image is found, and the smoke of the *patchak* religiously wends its way heavenward." It is now hardly known in Europe, but the Arabs and Chinese esteem it as highly as ever as an incense, and the Hindus use it as a perfume and medicine.

Sandal wood must have been used in India from prehistoric times, as it is mentioned in the Nirukta, or writings of Yaska, the oldest Vedic commentary extant. It is principally consumed at the funeral piles of wealthy Hindus, and even comparatively poor people will expend as much as 40 to 50 rupees worth at a funeral. In China it is burnt as an incense, and the Parsees also burn it. There would appear to be no evidence of its ever having found much favour as an incense in the West, which is strange, as it was known to the Romans in the first century of our era. A false sandal wood is imported into Bombay from Zanzibar, of which I show you a sample: it is used as a substitute for the true article. Several kinds of false sandal are also in use in China.

Common camphor is used as an incense in India, especially in performing the *arthi* ceremony already mentioned; whilst the expensive Borneo camphor is largely used at the funeral rites of the Batta princes, whose families are often ruined by the lavish expense of providing the camphor and buffaloes which the custom of their obsequies requires. In Western India it is used in small quantities by the Jains, and costs from 80 to 100 rupees per maund.

The *Cinnamon* and *Cassia* of the ancients appears to have been used as incense, as we find *Cassia turiana* mentioned as a substance upon which duty was levied at the Roman custom-house at Alexandria, A.D. 176-80; and a thick kind of cinnamon bark, called *Pisin-puttai* or *Piskoo-puttai* in Tamil, is still used in India for this purpose. It has a delicious fragrance, but hardly any cinnamon flavour. Mr. Hooper informs me that it is ground to a powder, mixed with water, smeared on reeds, and dried. The reeds are burnt at Mahometan festivals. There is a thick variety of Cassia which fetches about 56 shillings a pound in China: possibly it may be the same article.

The wood of *Cedrus Deodara*, the *Deodar wood* of the bazars, contains a large quantity of a very fragrant turpentine, and is much used all over India in making pastiles. *Pinus longifolia* is the *Sarala* of Sanskrit writers, who call the turpentine obtained from it *Sarala-drava;* it does not resemble our turpentine, but has the colour and consistence of *ghi*. Popularly it is known as *Chir-pine oil* or *Gandha-biroja*.

The roots of *Jurinea macrocephala,* a composite plant common in the Western Himalaya, are used locally as incense (*dhupa*). Dr. Stewart records that seven maunds from Bissahir were exposed for sale at the Rampur fair in 1867; and Dr. G. Watt saw the *dhup* being prepared from the roots in Rampur, and also higher up on the neighbouring hills, the plant being collected to be sent to Rampur. This substance is also said to be exported from Kashmir to Tibet for use as incense.

The wood, twigs, and resin of the *Himalayan Junipers* and of the *Himalayan Cypress* are used as incense in the Hindu temples of Northern India, and it is interesting to remember that the European species of these trees were used in the Trojan War in burning sacrifices to the gods.

In Kashmir the root of *Morina Coulteriana,* belonging to the *Dipsaceæ,* is in local demand as an incense. It is said to be sometimes mixed with *Costus* for export.

Myrrh and *Bdellium* are chiefly used as incense in China, but some European receipts for incense contain a little myrrh. The odour of bdellium when burnt is not agreeable, still it appears to have been used in Europe by the ancients, as Pliny states that its quality may be tested by its odour when burning. The refinements of civilization have greatly modified our appreciation of perfumes. In England three centuries ago our forefathers placed Valerian in their wardrobes and considered it an agreeable perfume; nowadays we should as soon think of keeping a polecat in our cupboards. In India, which has been stationary as regards refinement for the last three thousand years, Valerian is still used as a perfume for clothes, and is considered an agreeable addition to the hair douche. Bdellium has a decidedly musty odour, but Plautus in his "Curculio" uses it as a term of endearment: "Tu crocinum et cassia es, tu bdellium;" which may be freely translated, "You are a spicy darling." To his taste bdellium cannot have been musty. An idea of Solomon's taste in perfumes may be gathered from his Epithalamium: it would hardly meet with the approval of a modern bride.

The *Rala* or *Dhuna* of India is an interesting substance. I identify it with the *Cancamum* of the ancients. If we refer to Dioscorides, we find that he speaks of it as an Arabian gum, something like myrrh in appearance, used for fumigation on account of its fragrance and administered medicinally to reduce corpulence and to cure spleen,

&c.; it was applied locally to remove opacities of the cornea and improve the sight, also to cure toothache; according to Paulun Ægineta it was considered to be laxative. I think there can be no doubt that this substance was the *Kankahan, Kaikahar*, or *Kaighaman* of the Arabians, a kind of resin which they describe as having exactly the same properties as those attributed to Cancamum by Dioscorides. Haji Zein (A. D. 1368) describes it as having the appearance of Copal, and the Indian Mahometan writers on Materia Medica identify it with the *Rala* or *Dhuna* of India, which is Shorea resin, and which is used throughout the East as an incense. Pliny mentions *Cancamum* and *Tarum* (aloe wood) as coming from the country which produces cinnamon and cassia, and states that it was brought to Europe by the Nabatæan Troglodytæ, a colony of the Nabatæi. Another species of Shorea, *S. Talura*, Roxb., yields the *Sambrâni* incense of the Wynaad, and *Vateria indica*, Linn., belonging to the same family, the *Vellai Kungiliyam* incense of the Tamils, which burns with a clear steady light, giving off a pleasant smell and very little smoke. The *Gokal-dhup* of the hill tribes of Sikkim is obtained from *Canarium bengalense*, Roxb., an immense forest tree; it is a clear, amber-coloured resin, having something of the qualities of Elemi, a fragrant resin obtained from Manilla, the botanical source of which has not yet been satisfactorily determined.

Galbanum, the *Chelbenah* of the Jews, was an ingredient of the incense used by the ancient Israelites (Exod., xxx. 34), and it is now used in the Irvingite churches in London. It is brought to Bombay from Persia and is known in the bazar as *Jawáshir*, an Arabic corruption of the Persian name Gaoshir, "cow's milk." Its odour is by no means agreeable, and when burnt decidedly offensive, so that it is difficult to understand its being used as an incense. In Persia it is used to keep evil spirits from the houses of parturient women, and the Greeks and Romans used it to drive away noxious animals. Virgil in his third Georgic, speaking of the diseases of sheep, says:—

> "Disce et odoratam stabulis accendere cedrum,
> Galbaneoque agitare graves nidore chelydros."

("Learn also to burn the fragrant Juniper in the folds, and to drive away the fetid Chelydrus with the fumes of galbanum.")

We do not know exactly what the Chelydrus was. Nicander describes it as a kind of snake; some think it was a kind of tortoise; anyhow it was supposed to be injurious to the flock.

I will conclude by giving you a modern *recipe* for incense which appeared in a recent issue of the "Chemist and Druggist" newspaper:—

Olibanum	6 ounces.
Dry storax	3 ,,
Benzoin	3 ,,
Myrrh	1 ounce.
Cascarilla	1 ,,
Lavender flowers	2 ounces.

Powder coarsely and mix.

PROTECTIVE MIMICRY.

By Mrs. W. E. Hart.

(*Read before the Bombay Natural History Society on 27th July, 1891.*)

The particular form of mimicry I propose to discuss is that similarity in *appearance* borne by creatures of one species to those of another which enjoy some special immunity from attack by reason of the possession of some peculiar quality not possessed by the imitators. It is, of course, involuntary, and the result of evolution through long time, perpetuating and intensifying, until they become permanent and specific, accidental and variable resemblances which have proved useful in the struggle for existence. The instances, perhaps, most familiar to us in India are those of some common but very curious and interesting species of butterflies, which being edible themselves, and on that account liable to attack by insectivorous enemies, resemble in coloration and habit of flight certain other species which, by reason of their unpleasant taste and smell, are avoided rather than sought by the natural enemies of their race. Before proceeding to consider instances in detail, the fact is worthy of notice that this kind of mimicry seems to be far commoner among tropical than among English butterflies. The reason would be an interesting question, of which several solutions not unworthy of examination and discussion readily suggest themselves. For instance:—(1st) It may be that as edible insects have more enemies among the carnivorous birds, reptiles, and insects of a tropical jungle than in the woods and meadows of England, they require more means of protection in order to perpetuate their species; or (2nd), as the breeding season of insects is generally of short duration in a climate subject both to long droughts and torrential rains, it is necessary that they should have every means of protection against other foes; or (3rd) perhaps the race of butterflies is more ancient in the tropics than in temperate regions, as would seem to be indicated by the existence of a larger number of species, and therefore they have enjoyed a longer opportunity for the perfect evolution of accidental, variable likenesses into permanent, specific ones.

But whatever the reason, the fact remains that many species of butterflies not sought as food are imitated, sometimes very closely, in appearance by other species, which, not being blessed with a deterrent smell or taste, would, were it not for this likeness, be seized by every bird and lizard in search of a meal. Of the species protected by their evil smell or taste it is further to be remarked that they are generally of pretty large size, with a slow fluttering flight, and conspicuously coloured, as though they actually courted notice—hanging out danger signals, so to speak, for the purpose of warning off their enemies.

I will instance first *Danais chrysippus* of the family of *Danainæ*, almost every member of which has a strong unpleasant smell, and none of which are sought as food by bird or lizard. The male and female of this species are alike in general appearance, of a bright terra-cotta colour, strongly contrasted with the black and white tips of their forewings. They flutter lazily about on the flower heads whence they draw their sustenance. Among them a quick eye will detect the females of *Hypolimnas misippus*, also a common butterfly, but not so common as *Danais chrysippus*. Even when set side by side, the likeness is so strong that it might well deceive an unpractised observer into the belief that the two specimens are individuals of the same species. Again, some females of *Hypolimnas* *misippus*, without the black and white tips to the forewings, imitate *Danais dorippus*, a species, if distinct at all, very closely allied to *D. chrysippus*. But the occurrence of this variety of *H. misippus* in fairly plentiful quantities in the island of Bombay, where *Danais dorippus* seems not to be found at all, supports the view that *D. dorippus* is not a distinct species, but merely an accidental variety of *D. chrysippus*.

But the male of *Hypolimnas misippus*, with its dark wings, eyed with purple on the upper side and brown and white beneath, is so unlike the female that it might well be mistaken for a member of a different species. Unlike it is also in its habit. Being of a quick restless flight and quarrelsome disposition, it does not associate either with the swarms of *Danais chrysippus* or with its own females, but inhabits generally some particular bush or shrub, which it seems to consider its own property, for it resents the intrusion of any trespasser with all the fury of a game-preserving Squire, making short quick dashes at any creature approaching its domain, even if it be but an inoffensive biped armed with a green gauze net.

Another larger species of *Hypolimnas*, *H. bolina*, has also, though not in so marked a degree, this characteristic of a difference in coloration between the male and female, the latter imitating another species of the *Danainæ*, *Euplœa core*. The male of *Hypolimnas bolina* is distinctly and conspicuously eyed with spots of a brighter purple than *H. misippus*; but in the female these spots are reduced to a faint streak, which brings the general appearance of the insect to a closer resemblance to the brownish-purple hue of *Euplœa core* than of its own mate.

Euplœa core, besides the unpleasant taste common to its family, enjoys a further protection in the possession of a pair of yellow brush-like plumes which the male can at pleasure protrude from the end of its abdomen. This is not a feature peculiar to *Euplœa core*, certain species of the genus *Danais* also possessing it, but it is not common to the whole family of the *Danainæ*. These plumes seem to be charged with a concentration of the unpleasant smell of the family, and the use of them may be to ensure the pursuer getting a good mouthful or noseful of it before he seizes the fugitive, and thus be more certainly deterred from the intended capture. The bright yellow colour contrasting forcibly with the dark brown body no doubt acts as a danger signal to a pursuing enemy.

The possession of this additional protection would, of course, operate to make *Euplœa core* additionally unpleasant to its enemies; and perhaps that is the reason why it is imitated in appearance by more than one unprotected species. For instance, *Papilio panope*, a butterfly about the same size, in the general brownish-purple coloration of its upperside, and the row of whitish markings round the posterior edge of the hindwings, bears a strong resemblance at a distance to *Euplœa core*. So, again, in the light buff or cream-coloured wings strongly veined with black of *Papilio dissimilis* and *clytia*, as well as in their slow lazy flight, so unusual in members of the genus *Papilio*, we trace a likeness to several species of the *Danais* protected by their bad smell and taste. These resemblances are the more interesting as they tend to show that the likeness is a true imitation, the result of gradual evolution, and not a mere *persistence*, or survival of or reversion to an old type common to the whole race. For *Euplœa core* and *Hypolimnas bolina*, though belonging to the different subfamilies of *Danainæ* and *Nymphalinæ*, are yet members of the same family of *Nymphalidæ*. It might, therefore, be plausibly argued that the resemblance between them is but a reversion in both to some feature in a common ancestor. But the members of the genus *Papilio* belong to the wholly different division of the *Papilionidæ*. If, then, we are to infer that these resemblances are imitations evolved in the process of time for the purpose of protection, we are led to the conclusion that the imitating species is a later development than the imitated. For it would only be after the latter had proved by experience the value of the feature in which the resemblance lies that it would be found of service to the former. We thus arrive at an interesting conclusion regarding the relative ages of different species, which would seem to show that the whole division of *Papilionidæ* is of later birth than the *Nymphalidæ*—a theory which seems to derive additional support from the fact that the first pair of legs in the *Papilionidæ* are strong and perfectly developed, while in the *Nymphalidæ* they are imperfectly developed, as though the latter had in the course of a longer existence departed more than the former from the type of a perfect insect with six fully-developed legs.

Considering the size and strength of most species of the genus *Papilio,* their quick high flight, and their generally restless habits, it may seem strange that they should require any additional protection in a resemblance to members of another species. Yet the species I have mentioned are by no means the only ones that enjoy it. There is a common but very curious butterfly of the same genus, *Papilio polytes,* the females of which occur in three different forms. The first, black, with a row of cream-coloured spots round the posterior margin of its hindwings, resembles its own male; but the females of this type appear to be barren, never, so far as has been ascertained, laying any eggs. The fertile females imitate two other species, not, as in the instances I have yet mentioned, of another genus, but the same, *viz.*, *P. hector,* which has the body and hindwings marked with red, and the tips of the forewings with white; and *P. aristolochiæ,* also red and black, but with a large distinctive blotch of white of irregular shape about the middle of each hindwing. Indeed, the whole life of that remarkable insect, *P. polytes,* would seem to be one long course of deception. When first hatched, the larva, which is of sluggish habits and feeds on the upper side of the leaves of the sweet lime, where it would naturally be conspicuous to passing birds, so exactly resembles both in colour and shape the droppings of some small bird, that it may well deceive any except the most careful eye. As it grows too large to avail itself of this resemblance, the larva gradually changes in colour from its first dirty white and gray to the exact shade of green of the leaf on which it feeds. When it assumes the pupa form, it is of a bright green colour and is in shape exactly like a bent leaf with its edges curled inwards. It then attaches itself by the tail end to the stem of the food plant with its head upwards, and inclines its body outwards at a angle of about 45 degrees. In this position its resemblance to a leaf is so complete that it can with difficulty be distinguished on the spray even by those who know it to be there. Then when the imago emerges, if it be a fertile female, on whom the perpetuation of the species is to depend, it will be one of two types, resembling the individuals of a wholly different species. But the pupæ of larvæ hatched from the same brood of eggs result indifferently in males and in females of all three types.

From the foregoing remarks you will have gathered that, among butterflies, it is generally in the females and not the males of a species that you will find the mimicry of another species.

The reason for this is obvious, in as much as it is the females which lay the eggs that are of the most importance to the species in perpetuating its existence.

In the instance last given, you will have noticed that the female of *Papilio polytes* does not resemble an individual of another genus protected by its bad smell or taste, as is the case with the two species of *Hypolimnas* and those of *Papilio* first mentioned, resembling *Danais chrysippus, Euplœa core,* and other species of *Danais.* But the two types of fertile females of *Papilio polytes* resemble individuals of other species only of the same genus *Papilio,* and whether these other species of *P. hector* and *P. aristolochiæ* are protected by any bad smell or taste seems doubtful, most of the *Papiliones* being certainly edible. There must, however, be a reason for the resemblance in this case also. If it be not the same as in the other instances, possibly the more brilliant coloration in the fertile female is to make them more conspicuous to the males of their own species, and thus ensure its perpetuation. In one sense this would also be a protective mimicry, though it would be protective rather indirectly of the species than directly of the individual.

The few instances I have mentioned have proved suggestive of several interesting questions which are still awaiting a correct solution, and the whole subject of Indian butterflies will be found a wide field for enquiry, fertile in important questions of great interest, not to the entomologist alone, but to the student of Natural History in all its branches. Does not, for instance, the establishment of the fact of the mimicry by one species of another protected by its evil smell or taste from attack by its enemies, point to the conclusion that there must be in these enemies some faculty of remembering and communicating individual experiences and of profiting by the instruction of others? For, unless the results of experience were widely spread among its enemies, we should hardly find a system of mimicry among its different species so widely spread as we do in the race of butterflies.

MISCELLANEOUS NOTES.

No. I.—THE NATURAL ENEMIES OF THE LOCUST.

Acridium peregrinum.

At a meeting of the Asiatic Society of Bengal on Wednesday night, 3rd June, 1891, in the Society's house in Park Street, Mr. E. C. Cotes exhibited two insect enemies of the Punjab locust *Acridium peregrinum*, also a magic lantern slide, illustrative of what may, perhaps, be a contagious disease of the same insect. Locusts are now prevalent to an alarming extent both in Northern India and in Africa, so that the appearance of insect enemies and disease among them is of some importance, it being known that the increase of locusts to a great extent depends upon the presence or absence of parasites and disease.

The first insect exhibited was a parasitic fly not unlike a small house fly, which has been reared in large numbers from locust eggs sent to the Indian Museum last March by the district officers of Peshawar and Rawalpindi. Only a portion of these eggs produced locusts, the remainder yielding the parasitic flies, which were no doubt nourished at the expense of the locust eggs. These parasitic flies appeared in such numbers that they quite blackened the sides of the rearing cages. They have been identified by the well-known dipterologist, Monsieur J. M. F. Bigot, as a hitherto unknown species of the genus *Anthomyia*, to which also belongs the species *Anthomyia angustifrons*, which is an important parasite of the Rocky Mountain locust of America. The precise life-history of the Indian species is not yet known, but it is probably similar to that of its American relation, which, according to Dr. Riley, the United States Entomologist, deposits its own minute eggs in the ground close to where the locust has previously laid its eggs; minute maggots rapidly hatch out from the fly's eggs, and bore their way into the egg mass of the locusts where they feed upon the contents of the locust's eggs, and finally transform into little brown pupæ, from which the flies emerge ready to lay more eggs, and thus repeat the cycle of their existence.

The second insect is one that had recently been sent from Peshawar by Mr. Merk, the Deputy Commissioner, who wrote that it had appeared in vast numbers in his district where it was feeding voraciously upon the young wingless locusts. This insect is known to entomologists as *Calosoma orientale*, and belongs to a group of carnivorous beetles which feed upon other insects throughout the whole of their existence, and which are consequently likely to prove of considerable use in destroying the locusts.

The magic lantern slide, illustrative of what may perhaps be a locust disease, comprised drawings made under a microscope magnifying 230 diameters, of blood taken respectively from healthy and dead locusts which have been lately reared in the Indian Museum. These locusts, after hatching out from the eggs and living for some time in apparent health, began to sicken and die off in the most unaccountable manner, and the microscope shows that the blood of those that have died is simply swarming with minute corpuscles which are not present in similar blood taken from healthy individuals. The corpuscles have much resemblance to the ones that characterise the disease, known as *pebrine*, which is often excessively destructive to silkworms. But further investigation will be necessary to ascertain whether the corpuscles, found in the locust's blood, characterise a contagious disease, or whether the locusts have been dying from some other cause, in which case the corpuscles might perhaps be accounted for by *post mortem* changes that have occurred in the blood.

Upon the whole, it may be concluded that the appearance, both of parasitic insects and also of what seems likely to prove to be specific disease amongst the locusts, is a hopeful sign for next year, as it points to an approaching end of the locust plague. But at the same time it must not be forgotten that the rainy weather breeding season is now coming on, when every effort ought to be made to destroy the young locusts which may shortly be expected to appear in Rajputana, in the Punjab, and, possibly, also in some parts of the Western Districts of the N.-W. Provinces, for the number of winged locusts now flying about the North-West is so vast that if anything should go wrong with their natural enemies and diseases, terrible damage would certainly result to the crops, unless the most energetic measures are taken by the people to destroy what they can for themselves. It has been abundantly shown by what was done last year in some of the districts of the Punjab, that when the locusts are in their early wingless condition, they can be effectively stamped out, wherever they appear, provided well organized and sustained warfare is waged against them by the cultivators.

II.—TAMING A HERON.

One day during the recent monsoon a young Egret or Heron* with a greenish-brown neck and body, white tipped wings, and green legs, flew into the verandah of my house, apparently in search of food. I caught it and for about ten days kept it under a large basket, feeding it with raw meat. I then gave it its liberty, but it refused to leave. It grew very tame and would feed out of my hand. Occasionally it would indulge in a bath in one of the dog's tins, and afterwards sit on a chair in the verandah. In the evening it flew away to roost in one of the large neem trees in the compound. It showed no fear of any of my dogs, and would give any of them who came too near a vigorous dig with its long bill. It remained with me for about six weeks, when, as my Regiment was under orders to march, and I was afraid if left behind it would meet with an untimely end, I carried it down to the river about two miles off and left it there.

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* *Butorides javanica* (The Little Green Heron).

W. S. HORE,
Lieut. Colonel.

Deesa, September, 1891.

III.—SNIPE SHOOTING IN THE NEIGHBOURHOOD OF SECUNDERABAD.

It may be of interest, both to sportsmen and to Naturalists, to record the relative proportions of the four species of Snipe which fell to my gun during the past three seasons in the neighbourhood of Secunderabad. I was not shooting between January and March, 1889, so have nothing to compare with that period in 1890, but the results of the three seasons tend to show that the Fantails and Pintails are as nearly equally distributed in this neighbourhood as are the Jacks and Painters.

Date.	Fantails.	Pintails.	Jacks.	Painters.	Total.
1888.					
30th September	4	...	...	...	4
7th October	8	...	...	...	8
13th Do.	26	19	...	...	45
4th November	1	...	...	...	1
10th Do.	7	10	1	...	18
3rd December	9	9	3	2	23
16th Do.	22	12	3	...	37
17th Do.	40	42	...	...	82
18th Do.	12	2	3	1	18
Total...	129	94	10	3	236
1889.					
4th October	2	10	...	3	15
5th Do.	2	7	...	1	10
6th Do.	2	6	..	3	11
26th Do.	1	2	1	...	4
27th Do.	7	38	...	...	45
24th November	7	1	...	...	8
25th Do.	6	28	...	1	35
8th December	14	13	...	1	28
9th Do.	22	9	...	...	31
29th Do.	14	1	...	...	15
Total...	77	115	1	9	202

Date.	Fantails.	Pintails.	Jacks.	Painters.	Total.
1890.					
2nd January	16	6	5	4	31
3rd Do.	12	4	1	2	19
4th Do.	3	9	...	2	14
5th Do.	9	7	3	1	20
6th Do.	18	22	...	...	40
7th Do.	22	1	7	...	30
8th Do.	2	10	...	...	12
10th Do.	...	...	...	1	1
2nd March	5	3	...	...	8
7th Do.	4	3	1	...	8
Total...	91	65	17	10	183

Recapitulation.

1888	129	94	10	3	236
1889	77	115	1	9	202
1890	91	65	17	10	183
Total...	297	274	28	22	621

W. GAYE.

Secunderabad, Deccan.

IV.—MEMORY *versus* REASON IN CATS.

The following incidents connected with a Persian cat of mine seems to show that some cats at least do not reason, though they possess and exercise memory.

Incident No. 1.—The cat had two kittens in the corner of a bed room not in use. She was seen by me the day before yesterday to pass through the dining room with one kitten in her mouth, changing her quarters evidently. I followed to see where she would lie up, and found she had chosen a corner of the writing room. As she had only fetched one kitten I thought I would save her the trouble of going back for number two, so went and brought it. As I returned and got near her place the kitty mewed and the mother came to meet me. I handed her the little one and she took it in her mouth and laid it down beside number one and coiled herself up alongside. I returned to the dining room and in about ten minutes she trotted passed me back to the old corner in the first room and commenced a vigorous mewing and search as if she had remembered that she had left a kitten there, and had not carried it away. She returned in a great state of excitement to the kittens, sniffed them, lay down for a little, but again suddenly jumping up went to the corner in the first room and instituted a fresh search. How long it was before she was satisfied that she had not been deprived of a kitten I cannot say, for I had to go out, and by the time I returned she had settled down.

Incident No. 2.—The same cat turning up while I was at breakfast to-day, I sent a servant to see if the kittens in the writing room were all right. They were reported not to be there, but I was told that yesterday she had been seen transporting the kittens to a coach house near the stables, some 150 yards away from the house. I sent to have them fetched and shown to the mother, then I had them taken to an almirah in my bed room which formerly she had much affected. She followed the servant who carried them up, saw where they were deposited and returned to me to the dining room to finish her breakfast. She then immediately went back to the almirah and removed the kittens one after the other back to the coach house !

I trouble you with these incidents only because facts, however trivial, may, at some time or other be of use to those interested in such matters. You will observe that I am careful not to condemn all cats as wanting in reasoning power, as the data on which I draw my conclusions are furnished only by the conduct, under observation, of a single cat.

KENNETH MACKENZIE,
Colonel.

Amraoti Camp, Berar, 6th October, 1891.

V.—THE BREEDING OF SNAKES.

As little has been recorded about the breeding of snakes the following may be worth noting :—

On July 30th this year a large green tree-snake, *Dryophis mycterizans*, was brought to the Public Gardens here. On the 27th September she gave birth to 12 young ones, thus proving that this particular species is viviparous. The size of young snakes is usually about one-sixth of that of the adult, but the young in this case were about seventeen inches in length, the mother being about four feet six inches long. It is possible that the rule only holds good for those snakes that are hatched outside the body of the parent.

HAROLD S. FERGUSON.

Trevandrum, 30th September, 1891.

We have had several gravid females of the above mentioned snake in the Society's Rooms, and although the young ones were, in the majority of cases, produced alive, in one instance they did not hatch out until the day after the eggs were laid. *Dryophis mycterizans* may therefore be described as being *ovo-viviparous*, and I strongly suspect that all true tree-snakes are the same. Until steps are taken to keep Indian snakes, under observation, in properly constructed serpentaria, in this country, our knowledge regarding their habits will remain as limited as it now is.

H. M. PHIPSON,
Hon. Secy., Bo. Nat. Hist. Society.

Bombay, *6th October*, 1891.

VI.—HOW THE MONITOR OR GHORAPAD (*VARANUS BENGALENSIS*) DEFENDS ITSELF.

To-day, whilst reading in the verandah, I heard an unusual sort of noise, as of some creature careering over the gravel, and immediately got up to see what it was. A terrier, who had been asleep on the verandah steps, had also been disturbed by the noise, and when I looked up I found him standing face to face with a Ghorapad, or Monitor Lizard, about 3 feet long. They both appeared to be much astonished at the other's appearance. The Ghorapad evidently came to the conclusion that if there was to be a row in such an open space it ought to be fought out at once, and prepared himself accordingly, arching his back, swelling out the pouch under his throat, darting out his tongue in snake-like fashion, and hissing furiously. The dog for some time did not know what to make of such a strange creature, but eventually came to the conclusion that it ought to be worried and killed. He commenced the attack by rushing at his opponent's head, but the big lizard was equal to the occasion, and by suddenly turning round, presented his tail to the enemy, lashing out furiously with it and sending the gravel flying in all directions. Two or three times the dog returned to the attack, but always to find a tail where the head ought to be. Meanwhile a patiwala, hearing the noise, came on the scene, but quickly disappeared muttering something to himself of which only the words distinctly heard were " Karna ki waste." He shortly reappeared with a broad grin on his face and a thick blanket in his hand which he carefully threw over the Ghorapad, but the active creature slipped from under the *cumbli* and scuttled off for dear life towards the flower beds into which he escaped, thus saving his skin from adorning the family tom-tom, and depriving Gopal of a most tasty dish.

GEORGE K. WASEY.

Marmagoa, *8th October*, 1891.

VII.—BOMBAY FERNERIES.

With reference to the paper on " Bombay Ferneries," it has long appeared to me that the delightful recreation of gardening is much neglected in our large sea-side stations, and Mr. Carstensen will be doing Bombay a service if he succeeds in setting on foot a more active love of fern-growing—I say *active* advisedly; for growing ferns, or, indeed, any plants, in a vicarious way by

118

malis without intelligent and loving supervision by the owners, is after all a poor apology for gardening in the best sense of the word, and though a beautiful result may possibly be attained, it will generally be found, sooner or later, that the labels of valuable plants have been misplaced; that the collection is in confusion; and the plants themselves suffering from want of attention to such minutiæ as watering and drainage.

Ferns and crotons seem to form the chief attractions and to receive the greatest amount of attention in our Presidency gardens, but neither of these afford the pleasure to most people that is given by beautiful *flowering* forms of the vegetable kingdom, and it is, I think, a great mistake to imagine that a moist and warm climate is only, or chiefly, suitable for the cultivation of foliage plants.

Old residents in Bombay who had the privilege of visiting the beautiful, garden of Mr. Lloyd (then Judge of the High Court) will remember the display made there by a profusion of lovely flowering plants carefully selected to suit the climate, and lovingly tended by his own hands—such treasures as Dipladenia's, Allamandas, Poivreas, Combretums, Hoyas, Ixoras, Sonerilas, Anthuriums, Amaryllises, Aphelandras, and a hundred other choice "stove" flowering gems, to which a fine collection of ferns acted as a most effective background.

Is it true, as I am informed, that since those days, some twenty years or more ago, no such gardener has arisen in Bombay? If so, with the greater facilities for obtaining water that now exist, I can quite understand the necessity of Mr. Carstensen's lectures. In the few notices I have seen of late years of horticultural exhibitions in Bombay, I have been surprised to observe the very scanty mention made of orchids, a family of wondrous beauty, and universally admired wherever shown in good condition, a family, too, of which many of those most worth growing, would, I feel sure, thrive admirably under a thin coir matting shed in Bombay.

Amongst the Indian or Eastern varieties suitable for the Bombay climate I think the following best worth growing:—Ærides, Acanthophippiums, Anæctochilus, Calanthes, in many varieties, Cœlogynes, Cymbidiums, Cypripediums, Dendrobes—the two latter families in a hundred varieties, all beautiful—Saccolabiums and Vandas. Then amongst the still more lovely and rare species from South America and Africa a large selection may be made commencing with Angrœcum sesquipedale—probably the most wonderful of known orchids—from Madagascar, Cattleyas; from the warm moist valleys of Columbia, Brazil, and Venezuela, several Lælias, and orchis, Peristeria elata, "el spirito santo" of the Spaniards, from Panama, Vanilla Aromatica and all the Miltonias.

The "cool" Orchids from the New World, such as Odontoglossums, Lycastes and Masdevallias, which thrive so well in the open air under coir matting in my garden, would not be suitable for your climate but most of those termed "stove" orchids should find a congenial air in Bombay, Karachi, Calcutta and Madras, and the "cool" varieties mentioned would probably do well at Mahableshwar, or even at Matheran.

To the great beauty of this class of flowering plants may be added as an inducement to growing them the lasting value of their blossoms; for though some are evanescent, others remain in full beauty from 1 to 4 months, and a few, as the *Denbrobium superbiens*, for even six months.

The wonder is that orchids are not more frequently grown by those fond of beautiful flowers. If I can, in any degree, assist any person inclined to enter on this facinating branch of horticulture I shall be very glad to do so if they will address me on the subject.

FRANK GRIFFITH.

Kotagiri, Nilgiris, 6th October, 1891.

BOMBAY FERNERIES.

I have read with some interest Mr. Frank Griffith's letter,* under the above heading, and I quite agree with him that people in this country are not particularly enthusiastic about the cultivation of those charming ornaments of the vegetable kingdom—ferns, which are picturesquely described by a well-known writer on horticulture, as belonging to that extensive class called Cryptgams. "which celebrate their marriages in the dark." The same apathy is discernible in the cultivation of orchids. I am, however, of opinion that this apparent want of appreciation of the beauties of these two genera is due rather to a mistaken idea that they are extremely difficult of cultivation, than to any want of appreciation of their merits as ornamental plants. Another reason I believe to be the migratory character of European life in this country. People as a rule are disinclined to lay out money in gardens and plant-houses, which they may be called upon at any moment to leave behind, to meet the exigencies of the service, perhaps just as they had succeeded in rendering their home surroundings beautiful, by gathering around them a fine collection of plants. Those, however, who are more or less domiciled in this country may certainly do more than they have done to popularise the art of gardening, especially in the large presidency towns in India.

Native Chiefs, such as Jeypore, Oodeypore, Gwalior, Indore, and some others, have in recent years given considerable encouragement to high-class gardening by having large public gardens laid out at their capitals with generally a skilled European gardener to direct operations. But they might do more by spreading the knowledge and love of horticulture among their subjects by the training of apprentices at these large public gardens. When I was Superintendent of the magnificent "Ram Newas" public gardens at Jeypore some years ago, I had a number of lads under training, who proved very apt pupils, and are now, I believe, holding responsible posts as head *mallees* in different parts of Rajputana. But since the death of the late

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* This letter appeared in the *Bombay Gazette* on 10th October, 1891.

Maharaja no European gardener has supervised those gardens, and I hear they are not exactly in the condition in which I left them.

In conclusion, I would add that I also, like Mr. Griffiths, will be glad to assist with hints and suggestions those who desire to cultivate ferns and orchids successfully.

H. St. JOHN JACKSON.

Allahabad, 14*th October*, 1891.

VIII.—A FASTING SNAKE.

On the 29th September, 1890, a Python (*Python molurus*) was brought to the Public Gardens here, and we tried it with various animals regularly every fortnight, but until the 9th October, 1891, it ate nothing, when it took a single white rat, and two days afterwards it took two more. It was therefore without food for a year and ten days, during which time it changed its skin more than once, and always looked glossy and in perfect health.

HAROLD. S. FERGUSON.

Trevandrum, S. Travancore, October, 1891.

IX.—THE SAGACITY OF THE LANGOOR.

The following story was related to me by Ballaji, Patel of Kusba Serazgaon, yesterday, when I was encamped there :—

"About a year ago," he said, pointing to a well in a garden by the roadside, surrounded with high tamarind trees, "a woman of the Mali caste left her baby 3 months old in a swing by the well, and went into the garden to work. After a while she returned and found the child gone. It had on a red garment. Search was made everywhere, and at last a monkey was noticed at the top of one of the high tamarind trees with something in its arms, and there was no doubt it was the child. They did not dare to do anything, but went off to a distance from the tree and watched. After some time the monkey came down and put the child back in the swing. It was found unhurt and the little boy is alive now."

The monkey was a female, and belonged to the common species known as "Langoor."

FRED. WRIGHT.

Ellichpur, 6*th November*, 1891.

PROCEEDINGS OF THE MEETING HELD ON 27TH JULY, 1891.

The usual monthly meeting of the members of this Society took place on Monday last, the 27th July, Surgeon-General W. E. Cates presiding.

ELECTION OF MEMBERS.

The following gentlemen were duly elected members of the Society :—

Captain F. J. B. Campbell (Jhansi), Mr. F. R. Hutchinson, P. W. D. (Bombay), Mr. Harrington Bulkley (Kharagora), Colonel William Scott (Palanpur), Mr. G. C. Whitworth, Bo. C.S. (Nasick), Captain S. C. Smith, R. A., (Colaba), Mr. F. W. F. Fletcher (Tindivanam), Mr. T. Rogers Rean (Bombay), Major E. Balfe (Simla), Mr. H. A. Hole (Cachar), and Captain J. A. Bell (Deoli).

CONTRIBUTIONS DURING JULY.

The Honorary Secretary, Mr. H. M. Phipson, then acknowledged the following contributions to the Society's collections during the month :—

Contribution.	Description.	Contributor.
1 Snake	Dipsas gokool	Mr. C. E. Kane.
1 Desert Cat	Felis ornata	Major L. Fenton.
8 Antelopes' Heads	From Africa	Cowasjee Dinshaw and Bros.
1 Crocodile's Skin	C. gangeticus	Captain G. Sutton Jones.
3 Lizards (alive)	Uromastix hardwickii	Mr. C. F. Howard.
1 Large piece of Black Coral.	From Ceylon	Genl. La Touche.
1 Young Cobra (alive)	Naga tripudians	Mr. J. W. Fordham.
1 Lizard (alive)	Varanus bengalensis	Mr. E. Calthrop.
1 Curiously deformed pair of Cheetal Horns	Axis maculatus	Dr. Walker (through Brig.-Surg. W. Price).
1 Tortoise (alive)	Testudo elegans	Rev. B. d'Monte.

Minor contributions were also acknowledged from Mr. E. Giles, Colonel Carruthers, and Mr. Dorabjee Dadabhoy Boottee.

CONTRIBUTION TO THE LIBRARY.

Memoirs of the Geological Survey, in exchange; Dictionary of Economic Products of India, Vols. 1 to 4, from the Government of India; List of the Mammals in the Indian Museum, Calcutta, from the Trustees; and Photograph of the Traveller's Palm, from Mr. T. R. Fernandez.

DESIDERATA.

The Honorary Secretary stated, for the information of those members who are willing to assist in the improvement of the Scoiety's collection of horns, that really good specimens of the following are much wanted, those at present in the Society's Rooms being deficient in size :—Wild buffalo (male and female), Swamp deer, Neilgherry wild goat, and Muntjac, or ribbed-faced deer.

THE SOCIETY'S JOURNAL.

The Honorary Secretary stated, in reply to numerous enquiries, that all the back numbers of the Society's Journal are still available, and could be purchased *by members* at Re. 1-4 each. As in a few years a complete set of the Journal would in all probability be of considerable value, owing to the expensive plates which they now contained, members were recommended to see that their files are complete, and to replace any numbers which might be missing while they are still procurable.

A MAN-KILLING BEAR. *

Mr. Reginald Gilbert read an interesting account of a she-bear which had attacked and seriously injured four or five persons, in the State of Dharampore, during the last year. Mr. Gilbert and Mr. E. L. Barton succeeded in killing the bear and her two cubs on the 24th May last, on which day she had, without any provocation, attacked and killed a man while he was lying on the ground smoking. It was found on examining the bear that the bone of her forearm had been splintered some time before, and that the bullet was still in the flesh. The wound had closed; but as there was a good deal of inflammation, it had probably given her much pain, and was no doubt the cause of her man-killing proclivities.

PROTECTIVE RESEMBLANCES.

Mr. W. E. Hart read a paper by Mrs. Hart on the above subject, dwelling particularly on the similarity in *appearance* borne by creatures of one species to those of another which enjoy immunity from attack by reason of some peculiar quality not possessed by their imitators. Mr. Hart illustrated Mrs. Hart's paper with examples taken from the Society's collection of butterflies, and demonstrated, with much clearness, this curious result of evolution which exists more particularly in the insect world.

A PANTHER EATING A PANTHER. †

The next paper was by Mr. E. L. Barton, containing an account of an incident which occurred in Ceylon some years ago, when a female panther was eaten by another (presumably a male) after it had been wounded by a bullet while they were apparently engaged in fighting. The question which remained to be settled was whether the struggle, which was observed, was a fight between two hungry animals of the same species, with the ultimate intention of the victor making a meal off the vanquished, or whether it was only a lover's quarrel which, ending in death, had furnished the male with food.

THE MIGRATIONS OF BIRDS. ‡

The Honorary Secretary read a paper by Mr. E. H. Aitken, containing an important suggestion that the Ornithological Committee of the Society should invite the co-operation of members in different parts of the country in order that the migrations of various birds from one part of India to another might be observed and recorded. Several instances were given, such as the common green bea-eater (*Merops viridis*) which disappears from Bombay about the beginning of April, and does not return until the end of the rains. It is not at present known where it goes.

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* See page 276

† See page 274

‡ See page 268

It was resolved that the suggestion made by Mr. Aitken was a valuable one, and should, if possible, be acted upon.

Surgeon-General Cates then proposed a vote of thanks to the lady and gentlemen who had written the papers, all of which should, it was resolved, be published in the Society's Journal.

The meeting then ended.

PROCEEDINGS OF THE MEETING HELD ON 1st SEPTEMBER, 1891.

The usual monthly meeting of the members of this Society took place on Tuesday, 1st September, Mr. W. E. Hart presiding.

The following gentlemen were elected members of the Society :—Mr. H. H. G. Dunlop (Poona), Doctor W. H. Quicke (Kaira), Mr. J. J. Benson, C.E. (Porebunder), Surgeon-Major John H. Newman (Ajmere), Mr. Andrew Johnston (Coorg), Mr. H. E. Proctor (Bombay).

CONTRIBUTIONS DURING AUGUST.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions received during the past month :—

Contributions.	Description.	Contributor.
2 Squirrels (alive)	Sciurus palmarum.	Mr. Tribhuvandas Mungaldas Nuthoobhoy.
1 Porcupine Fish	Diodon hystrix.	Purchased.
1 Snake	Tropidonotus quincunctiatus.	Mr. T. R. Rean.
1 Scaly Ant Eater (alive)	Manis pentadactylus.	Mrs. N. R. Oliver.
1 Black Cobra (alive)	Naga tripudians.	Mr. S. Duigan.
1 White Crow	Corvus splendens.	Mr. A. Elliott.
1 Snake	Dipsas gokool	Mrs. Bisset.
1 Hyæna (alive)	Hyæna striata.	Mr. F. Prideaux.
1 Pair deformed Cheetal Horns.	Axis maculatus.	Mr. E. W. Moffat.
1 Skink (alive) with	a bifurcated tail.	Mr. T. C. H. White.
3 Snakes (alive)	Gongylophis conicus.	Rev. F. Dreckmann, S. J.
2 Cobras (alive)	Naga tripudians.	Capt. W. Ross.
1 Snake	Oligodon subpunctatus.	Col. Baddeley.
1 Large Centipede (alive)	Scolopendra gigantea.	M. G. H. Alier.
2 Black Cobras (alive)	Naga tripudians.	Mr. J. W. Fordham.
1 Crocodile's Skin	Crocodilus palustris.	Mr. J. C. Anderson.
1 Dhaman	Ptyas mucosus.	Mr. E. H. Elsworthy.
1 Bird-Eating Spider	Mygale fasciatus.	Miss A. Walke.
1 Snake	Gongylophis conicus.	Capt. G. M. Porter, R. E.
1 Chameleon (alive)	Chameleo calcaratus.	Mr. Bori.
1 Cobra	Naga tripudians.	Mr. M. C. Turner.
A number of Insects	&c., from Jubbulpore.	Mr. J. A. Betham.
1 Snake (alive)	Daboia elegans.	Mr. H. W. Barrow.

MINOR CONTRIBUTIONS.

From Captain the Hon'ble R. Tyrwhitt and Dr. L. B. Dargalker.

CONTRIBUTIONS TO THE LIBRARY.

Bulletin de la Société de France pour Juin, 1891. In exchange.

The Destructive Insects of Victoria (French). From Author.

The Victorian Naturalist (June to August, 1891). In exchange.

Transactions of the New Zealand Institute. In exchange.

The Classification of Birds (Bowdler Sharpe). From Author.

Hesperiidæ Indicæ (E. Y. Watson). From Author.

The Indian Forester (August, 1891). In exchange.

Verhandlung der Zoologisch botanischen Gesellschaft in Wein. In exchange.

Pasteur System of protective Vaccination for Anthrax (G. J. R. Rayment). From the Author.

A VALUABLE PRESENT DECLINED.

The Honorary Secretary read a letter from Colonel H. L. Nutt, the Political Agent at Savant Vadi, offering to present, through the Society, a full-grown young male tiger to the Victoria Gardens. The Honorary Secretary stated that he had, after consulting the Municipal Commissioner, written to Colonel Nutt, with much reluctance, declining his valuable present, as there is no suitable accommodation for the animal at the Gardens. Mr. Phipson added that the recent improvements which had been made in the way of cages at the Victoria Gardens were principally due to the liberality of the Bombay Tramway Company, H. H. the Thakore of Bhownuggur, and Sir Dinshaw Maneckjee Petit; but he trusted that before long the Municipality would take steps to improve its zoological collections in this respect out of its own resources. Another member of the Society had a short time ago offered to obtain a pair of Kattywar lions for the Bombay Zoo, but this offer had also to be declined for the same reason.

ON ABNORMAL HORNS.

The Honorary Secretary read an interesting paper received from Mr. A. W. Morris, of Bangalore, entitled "*On Abnormal Horns of the Indian Antelope, with some remarks on their probable causes*,"

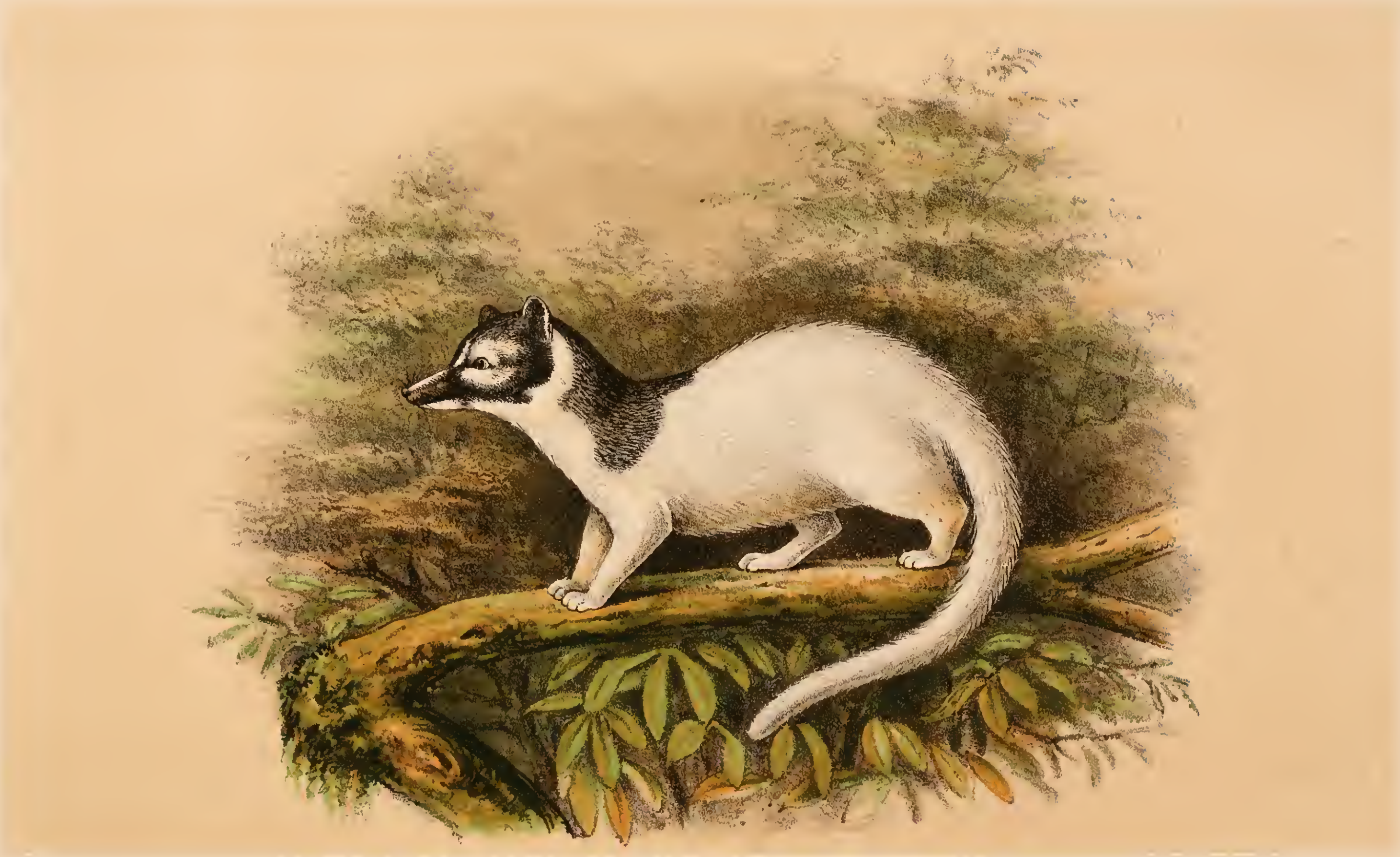
A NEW SPECIES OF PALM CIVET.

The next paper read at the meeting was from Mr. James Taylor, of Orissa, containing a description of a new species of Palm Civet (*Paradoxurus*) found by him, which he proposed to name *Paradoxurus nictitatans* from the fact that the nictitating membrane (or third eyelid) is, in this species, most perfectly developed and constantly made use of. The Honorary Secretary stated that a sketch of the animal received from Mr. Taylor had been forwarded to Messrs. Mintern Brothers, London, in order that an illustration may accompany the publication of the paper.

THE MAMMALIA OF SOMALI LAND.

Mr. J. D. Inverarity read the first part of a most interesting paper on the Mammalia of Somali Land, containing a graphic and detailed description of all the animals which he had met with during his two sporting tours in that country. The remaining portion of the paper will be read at the next meeting, and the whole will then be published, with numerous photographs, in the Society's Journal.

Mr. Hart, while proposing a vote of thanks to Mr. Inverarity, stated that the paper was, in his opinion, an exceedingly valuable one, as it contained information, recorded by an accurate observer, respecting several animals about which very little had been written.



Jas. Taylor pinx

Mintern Bros. Chromo lith. London

PARADOXURUS NICTITATANS. (Taylor.)
A new species of Palm-Civet found in Orissa.

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JOURNAL
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No. 4.] BOMBAY, 1891. [Vol. VI.

DESCRIPTION OF A NEW SPECIES OF PALM-CIVET *(PARADOXURUS)* FOUND IN ORISSA.

By James Taylor.

(*Read before the Bombay Natural History Society on 1st September 1891.*)

Received, 30 *July,* 1891.

(*With a Plate.*)

Paradoxurus nictitatans, sp. nov.

Head and Body	20″
Tail	18″
Greatest length of Skull	4″
Greatest breadth of Skull	$1\frac{5}{8}''$

Muzzle blackish brown, lighter near the nose, a central white line down the muzzle. Head grizzled black and white, a dark line through eye to cheek, meeting another dark band from corner of mouth, enclosing a whitish infra-orbital space. Cheek greyish-black with but few white hairs. Forehead grizzled black and white, lighter over the eyes, with central black line down the forehead to muzzle. Back of neck and shoulders grizzled black and white, some hairs white, some tipped black, others all black, forming a kind of saddle. Chin and throat white, a broad white band passing up behind the ears, forming a semi-collar. Whiskers mostly black, a few white bristles. The rest of the body and tail white, with a yellowish tinge on the limbs and belly.

Last May, when in the Kondmals—a Government estate in the Gurjats of Orissa—a Kondh brought me in this new *Paradoxurus.*

It was a beautiful little creature, only a month or so old; its body and long tail a lovely, fluffy, creamy-white, relieved by the dark markings on its shoulders and head. I recognized at once that I had struck oil, and made every enquiry about the animal. Its mother had been chased and killed by a party of Kondhs; they had captured the young one to bring to me, but alas! had eaten its mother.

They told me it resembled the young one in appearance, but was much larger. They called it "Markhor Berana," from its long tail, which they likened to that of the "Markhor" or Langur monkey.

They informed me it was very rare, only met with in the deeper forests, far away from villages, and that it nested in trees.

I named my little stranger "Raja." At first he would touch nothing but mangoes and milk; of the former he was very fond, and would eat four or five a day. Subsequently I fed him on puddings made of rice or soojee and milk sweetened, for he would not touch it without sugar. I occasionally gave him a little meat, either raw or cooked, as a treat. He increased rapidly in size and had an omnivorous appetite. Rats, birds, white ants, grasshoppers, fruits of all kinds, were eagerly devoured. He attacked and killed several small harmless snakes, crushing in their heads with his needle-like teeth.

I used to let him out of his cage a good deal, and he was very fond of scampering about the house with his tail held straight out behind him, and carefully kept from touching the ground. He was a clean little beast, but on maturing he developed a sickly odour, caused by a secretion from two subcaudal glands.

He became very tame and would climb up on to my knees and shoulders for a spoonful of sweet tea, of which he was excessively fond. On several occasions when he climbed into a tree and we were almost fearing we should lose him, I have coaxed him back by rattling a spoon against a tea-cup. Whenever he had an opportunity he would scramble up the wooden posts of the verandah, like a cat, and sleep, curled into a ball, on the beams. He used to lie flat on his back at other times, in the most human positions, with his head resting on one arm, and was a very interesting pet. Although he objected to have his body touched, I used to carry him about by his tail without his struggling or attempting to get away.

The tail was much developed in bone and muscle, of equal length to his head and body, and appeared to be a most powerful organ, much more so than its use would, at first sight, seem to warrant, but I noticed he used it much in balancing himself when walking on a thin branch. Also when descending a post, head first, he would half curl it round the wood, and by pressing hard with it would, by this means, assist in supporting himself. Coming down a clothes-horse I noticed he used to hook his tail over one bar when descending to a lower. The tail was therefore decidedly semi-prehensile and of considerable use to an arboreal animal like himself.

His temper was not sweet, being, without doubt, short and nasty; he considered his cage as his castle, and actively objected to any trespass on his domain. He would spit and swear like a cat, and, with his long fluffy hair all on end, looked the handsome little spitfire he was. A rare bully, too, he was; he knew the dogs had been forbidden to molest him, and he would creep up to them when sleeping, nip their tails, and frisk off in the cheekiest manner imaginable. The younger dogs he used to worry until they left the verandah in disgust.

When pleased with himself and all the world, he would roll himself into a ball, bury his nose in his tail, and pour forth his happiness in a low chirruping purr which he would keep up for half an hour at a time.

I have also heard him make strange squeaking and chattering noises like a nestful of young mice. His front feet were rounded and resembled those of a cat, but with semi-retractile claws; the hind feet were more like those of a squirrel, his gait moreover was more like that of that animal than of any other. The chief feature that I remarked was the great development of the nictitating membrane. This was as perfect as in many birds, and could be easily drawn over the pupil. It was put in action at long and varying intervals, but was in use throughout the day. I was so struck by this unusual development that I have named the animal from this peculiarity. Latterly he slept throughout the greater part of the day, being very restless at night, pacing to and fro in his cage and not sleeping a wink until daybreak.

After keeping in good health for some seven months, one morning I found he was biting the hair from the root of his tail. I applied lotions and ointments without avail, the irritation spread up his back and down the tail, and he could not be kept from savagely biting his flesh. Despairing, at last, of curing him, and fearing to lose the skin as a specimen, I, with great reluctance, administered a tea-spoonful of hydrocyanic acid. He gave two piercing screams, but nevertheless life was not extinct until fifteen minutes had elapsed after administering this large dose.

Up to my leaving the Kondmals, I was unable to obtain another specimen—although I heard of one,—nor am I surprised. The retiring disposition of this creature, its nocturnal habits, and the dense forests which it inhabits, all tend to make it a very rare capture.

JAMES TAYLOR.

Orissa.

A LIST OF THE BUTTERFLIES OF TRAVANCORE.

By H. S. Ferguson, F.L.S.

Before giving a list of the butterflies of the Native State of Travancore, it is necessary to give a slight sketch of the physical features of the country and of its climate, to explain the somewhat peculiar constitution of its fauna.

Travancore is a narrow strip of land, more or less triangular in shape, to the extreme south-west of the peninsula: it stretches from Cape Comorin, in the extreme south, northwards for about 174 miles, where it is bounded partly by the Native State of Cochin and partly by the British district of Coimbatore. On the west it is bounded by the sea, while on the east the water-shed of the range of hills which runs from Cape Comorin northwards parallel to the coast is, with a few exceptions, the boundary. Its greatest breadth is 75 miles. Zoologically it belongs to the Ceylonese sub-division of the oriental region.

The chain of hills for the first half of its length, that is from Cape Comorin to the Achankōvil gap, rises rather abruptly from the level of the low country, and consists merely of a single ridge with outlying spurs, so that, standing upon the boundary, you can, in many places, look down on the one hand into the flat land on the British side, and on the other into the low country of Travancore, thus affording a great contrast, for the latter is not flat but consists of a succession of low hills divided by narrow valleys, which are usually filled with paddy, the hills being covered with trees and undergrowth, so that the eye is carried down over a succession of dark green ridges, interrupted only by the bright green of the paddy lands, and the gleam of water in the large lakes, to the light green of the belt of cocoa-nut palms that fringes the white sand beyond, and so down to the sea. These lakes, or "back-waters," as they are called, are close to the sea, and, being united by canals parallel to the coast, form a waterway throughout the whole length of the country.

This first half of the range has an average height of 4,500 feet; only two of the peaks reach 5,000 feet, Agasthiar being 6,800 feet high, while Mahindragerry is 5,500. The first forty miles of the range from Cape Comorin are known as the Ashambu hills, and include the second of the two peaks mentioned. The next part is not known by any general name, but includes Agasthiar (6,200 feet), Chimmunji (4,800 feet), and Ponmudi, a grass hill, 3,500 feet high. It ends at the Ariankávu pass, 1,210 feet high. About 8 miles further is the Achankōvil pass, about 1,470 feet high; a strong ridge 2,000 to 3,000 feet separates the two valleys.

From base to summit the hills of this part of the range are covered with a dense growth of evergreen forest, and there is very little grass, in fact it only grows in some of the outlying spurs and on the more exposed ridges. From the Achankōvil pass the ridge gradually rises and broadens, till it forms, at an elevation of 3,500 feet, a table-land of unexplored forest, impassable by reason of its deep ravines and heavy undergrowth; this part stretches for about 15 miles, and is known as the Panthalam hills. Its character then changes, and we have instead of continuous forest a grass-covered plateau with scattered patches of forest at about the same elevation, to this the name of Pirmerd has been given on account of the presence there, at some former period, of a "pir" or hermit. This plateau extends some forty miles to the Cardamom hills, when forest again takes the place of grass, and the range gradually rises till it forms the "high range," which has an average elevation of about 6,500 feet, while the highest peak (Ancimudi) reaches 8,870 feet. This peak is the centre from which spring the Ancimullay on the north and the Palni hills on the east. One characteristic of the whole range is the presence of a reed called *irul* or *etah*, botanically *Beesha travancorica,* which clothes the sides of the hills in many places to the exclusion of all other growth whatever.

The annual rainfall varies in different parts, but is abundant everywhere, except in the extreme south. In Trevandrum in the low country, about 50 miles from Cape Comorin, it averages 65 inches, distributed as follows:—33 inches in the south-west monsoon, 23 in the north-east, and 9 in the dry months. Forty miles south the rainfall is only 25 inches in all; while 40 miles north at Quilon it is 62, 29 and 8, and some 40 miles further north still at Alleppy it is 70, 37 and 13 in the same periods.

It is this abundant rain-supply that keeps down the temperature, for though Trevandrum is less than 10 degrees from the equator, the temperature averages only 85°, and rarely rises above 90° in the hot weather.

In the Ashambu hills the rainfall is from 80 to 100 inches, at Ponmudi it is 180, at Pirmerd it is 207, and on the high range about 104.

The average temperature on the hills at an elevation of 2,100 feet is about 75° F.

Travancore then may be characterized as a country having a hot moist climate, an abundant vegetation, and an even temperature. I first began collecting butterflies in 1878, and for about two years and a half collected almost entirely in the Ashambu range and about Ponmudi. Since then I have collected off and on, in or about Trevandrum, and have had no opportunity of collecting for more than a week or two in the year on the hills. I have latterly employed a native to collect for the museum here. Trevandrum is situated about two miles from the sea, and within 20 miles in a direct line of the foot of the hills. At first I did not label each butterfly as I took it, but merely kept a list and sent duplicates from time to time to be identified. One butterfly alone I am unable to vouch for personally, *Tajuria maculata;* it was given to me in 1879 by Mr. Garrett, a planter who was living on the next estate. Mr. de Nicéville, to whom I sent the specimen some years later, was not satisfied with the evidence for its occurrence in Travancore, as it had only been recorded from the hills of North-Eastern India, and I had not labelled the specimen at the time I received it from Mr. Garrett. I do not think, however, there is room for doubt, for Mr. Garrett collected only in Travancore, and received no exchanges from any one, and I can vouch that the specimen I received from him was the one identified by Mr. de Nicéville as *T. maculata.* I have therefore included it in my list.

Family NYMPHALIDÆ.

Subfamily EUPLÆINÆ, Moore.

Group *Limninæ*, Moore.

1. *Hestia malabarica*, Moore.
   1,000 to 3,000 ft., fairly common. On one occasion I found numbers of them floating about the trees in the forest at Pirmerd. I have not seen them in such numbers on any other occasion.
2. *Danais (Tirumala) limniace*, Cramer.
   Common from the foot of the hills to the summits.
3. *Danais* (*Tirumala*) *septentrionis*, Butler.
   Fairly common.
4. *Danais* (*Limnas*) *chrysippus*, Linnæus.
   Abundant, especially at low elevations.
5. *Danais* (*Salatura*) *genutia*, Cramer.
   Even more common than *D. chrysippus*.
6. *Danais* (*Parantica*) *aglea*, Cramer.
   Common in the low country about Trevandrum and at low elevations in the hills, less so in the higher ones.
7. *Danais* (*Badacaraglin*) *iriensis*, Moore.
   Fairly common from 2,000 ft. upwards.
8. *Euplœa* (*Crastia*) *core*, Cramer.
   Common all the year round in the low country.
9. *Euplœa* (*Pademma*) *kollari*, Felder.
   Not uncommon at low elevations.

10. *Euplœa* (*Narmada*) *coreoides*, Moore.
Often associated with *C. core*. Fairly common.

Subfamily SATYRINÆ.

11. *Mycalesis* (*Virapa*) *anaxias*, Hewitson.
Not uncommon, 2,000 to 4,000 ft. Always in forest.

12. *Mycalesis* (*Orsotriœna*) *mandata*, Moore.
Form *mandosa*, Butler.
Common, found in the plains and up to 3,000 ft. *Mandosa* is the dry-season form.

13. *Mycalesis* (*Calysisme*) *blasius*, Fabricius.
Fairly common on grassy lands.

14. *Mycalesis* (*Calysisme*) *mineus*, Linnæus.
Form *justina*. Common. Found on the sides of roads in forest.

15. *Mycalesis* (*Calysisme*) *perseus*, Fabricius.
Form *visala*, Moore.
Common.

16. *Mycalesis* (*Nissanga*) *oculus*, Marshall.
Common in forest over 3,000 ft.

17. *Mycalesis* (*Nissanga*), *junonia*, Butler.
Not uncommon. I have taken it sparingly in the low country round Trevandrum and in forest below at 1,000 ft. It occurs commonly.

18. *Lethe europa*, Fabricius.
Rare; one specimen taken in the plains near Trevandrum, another on the high range.

19. *Lethe todara*, Moore.
Not common. 2,000 to 5,000.

20. *Lethe neelgherriensis*, Guérin.
Common. At 2,000 ft. and upwards.

21. *Ypthima baldus*, Fabricius.
Common on the hills from the foot to about 3,000 ft.

22. *Ypthima huebneri*, Kirby.
Common in the low country about Trevandrum in grass.

23. *Ypthima ceylonica*, Hewitson.
Rare; I took two specimens, at about 4,000 ft., on the boundary between Travancore and Tinnevelly, and a third in the Achancovil gap, about 800 ft.

24. *Ypthima chenui*, Guérin.
Not uncommon. I have taken it at about 800 ft., and it is probably to be found on the high range, as Mr. Hampson says, it is "found on the Anaymalai hills."

25. *Ypthima ypthimoides*, Moore.
Common in grass land on the hills over 3,500 ft.

26. *Zipœtis saitis*, Hewitson.
Not uncommon, 2,000 to 3,000 ft.

27. *Melanitis aswa*, Moore.
Rare, found only on the hills.

28. *Melanitis bela*, Moore.
Very rare; one specimen only taken.

30. *Melanitis leda*, Linnæus.
Form *ismene*, Cramer.
Very common, flies at dusk in the low country. Abundant in the hills in heavy forest where there is no undergrowth.

31. *Parantirrhœa marshalli*, Wood-Mason.
I have taken this at the foot of the hills in July in *Etah* jungle (*Beesha travancorica*). It is by no means common. Mr. Imray writes to me from Pirmerd: "They appear from May to the end of October, and only frequent thick *Etah* jungle; I have taken them on the wing only on damp drizzly days."

Subfamily ELYMNIINÆ.

32. *Elymnias caudata*, Butler.
Common up to 3,000 ft.

Subfamily MORPHINÆ.

33. *Amathusia phidippus*, Linnæus.
Rare. I have only taken two specimens in Trevandrum. I saw a third which settled on the ceiling cloth of the porch of a house where I was making a call, when I caused some surprise by suddenly dashing out of the room, into the porch, only to see *A. phidippus* calmly flit away.

34. *Discophora lepida*, Moore.
Male rare, female very rare. I have only taken one specimen of the latter. The male I have taken always near streams in heavy forest at about 2,500 ft. elevation. The one specimen of the female I took flew from under the overhanging bank of a stream in a belt dividing two clearings on the Mynall coffee estate.

Subfamily ACRÆINÆ.

35. *Telchinia violæ*, Fabricius.
Common in the low country and up to 2,000 ft. in the hills.

Subfamily NYMPHALINÆ.

36. *Ergolis merione*, Cramer.

37. *Ergolis taprobana*, Westwood.

38. *Ergolis ariadne*, Linnæus.

39. *Euripus consimilis*, Westwood.
Very rare. Mr. Garrett took one specimen near Ariankâve which is now in the Indian Museum, Calcutta.

40. *Cupha erymanthis*, Drury.
Common up to 3,000 ft.

41. *Atella phalantha*, Drury.
Common.

42. *Cethosia mahratta*, Moore.
Common from foot of hills up to 3,000 ft.

43. *Cynthia saloma*, Swinhoe.
Fairly common. The male more so than the female.

44. *Rohana camiba*, Moore.
Rare. Mr. Doherty records it from Pirmerd. Mr. Imray has also taken it there at an elevation of 2,400 ft., and I have received a specimen from the high range.

45. *Precis iphita*, Cramer.
Very common in the low country and in the hills up to 3,000 ft.

46. *Junonia almana*, Linnæus.
Form *asterie*, Linnæus.
Common in the low country; the latter appears to be the wet-season form.

47. *Junonia atlites*, Linnæus.
Very common in the low country and at the foot of the hills.

48. *Junonia lemonias*, Linnæus.
Common in the hills up to 2,500 ft.

49. *Junonia hierta*, Fabricius.
Common. Often found settling on the roads or in open spaces.

50. *Junonia orithyia*, Linnæus.
Common in the low country; of the same habits as the last.

51. *Neptis ordonia*, Stoll.
Form *plagiosa*, Moore.
N. hordonia is the wet-season form, and is much commoner than *N. plagiosa*.

52. *Neptis viraja*, Moore.
Rare. Two specimens taken near Trevandrum in July, 1890.

53. *Neptis varmona*, Moore.
Common in the hills and plains nearly all the year round.

54. *Neptis kallaura*, Moore.
Rare. Taken on the hills near Mynall estate and also on the high range.

55. *Neptis jumbah*, Moore.
Fairly common in the low country and up to 3,000 ft. in the hills.

56. *Cirrhochroa relata*, de Nicéville.

57. *Cirrhochroa thais*, Fabricius.

58. *Cirrhochroa swinhœi*, Butler.
All these are fairly common in the low country and in the hills up to 3,000 ft.

59. *Hypolimnas bolina*, Linnæus.
Very common in the hills up to 3,000 ft.

60. *Hypolimnas misippus*, Linnæus.
Common. Only one form of the female occurs "mimicking" *L. chrysippus*.

61. *Argynnis niphe*, Linnæus.
Found rarely at Pirmerd, common on the high range, the male more so than the female.

62. *Parthenos virens*, Moore.
Common on the lower slopes up to 1,200 ft.

63. *Moduza procris*, Cramer.
Common at the foot of the hills.

64. *Athyma perius*, Linnæus.
Rather rare. 2,000 to 4,000 ft.

65. *Athyma mahesa*, Moore.
Very rare. Only one specimen taken at 2,000 ft.

66. *Athyma selenophora*, Kollar.
Not uncommon on the hills, the female is rarer than the male.

67. *Athyma inarina*, Butler.
Very rare. One specimen only taken in July, 1890, near Trevandrum.

68. *Euthalia evelina*, Stoll.
Rather rare. I have taken it in June and July near Trevandrum and up to 1,800 ft. in the hills.

69. *Euthalia lepidea*, Butler.
Common in the low country and in the hills up to 3,000 ft. It has a habit of flying into the verandah in the low country and settling on the white walls or ceiling cloth.

70. *Euthalia garuda*, Moore.
Very common both in plains and hills. A form of the male occurs in which the discal spots are obsolete.

71. *Euthalia lubentina*, Cramer.
Not uncommon in the low country, not found on the hills.

72. *Pyrameis cardui*, Linnæus.
Common near Trevandrum and up to 3,000 ft. in the hills.

73. *Pyrameis indica*, Herbst.
Rare in the south, and not under 4,000 ft. elevation. Common in the high range.

74. *Vanessa canace*, Linnæus.
Common on the hills, generally found near streams.

75. *Cyrestis thyodamas*, Boisduval.
Common on the hills.

76. *Kallima philarchus*, Westwood.
Not common. This is the *Kallima* having the apical process of the forewing long, the base of the wings blue, and no hyaline discal spots.

77. *Kallima wardi*, Moore.
Not common. In this the base of the wings is greenish, and there are two prominent discal hyaline spots on the forewing.

78. *Doleschallia polibete*, Cramer.

Rare. I have only taken two specimens, one on the hills, one near Trevandrum.

79. *Charaxes schreiberi*, Godart.

Very rare. I have only once seen what I believe to be this butterfly, and Mr. T. F. Bourdillon sent me a single forewing that he picked up on the hills. Mr. Imray has taken it on Pirmerd at an elevation of 3,700 ft.

80. *Charaxes athamas*, Drury.

Common on the hills from the foot up to about 3,000 ft.

81. *Charaxes fabius*, Fabricius.

Fairly common in the low country, not found in the hills.

82. *Charaxes imna*, Butler,

Not uncommon in the low country and at the foot of the hills.

Family LEMONIIDÆ.

Subfamily Libythæinæ.

83. *Libythea myrrha*, Godart.

Form *rama*, Moore.

Common on the high range.

Subfamily Nemeobiinæ.

84. *Abisara prunosa*, Moore.

Common in the hills at the sides of roads in jungle, also in the low country. They vary a good deal, and some are quite undistinguishable from *A. suffusa* of the Nilgiries.

Family LYCÆNIDÆ.

85. *Neopithecops zalmora*, Butler.

Common in the low country. The dry and wet-season broods do not differ much in the extent of the white markings.

86. *Spalgis epius*, Westwood.

I have taken this near Trevandrum, and up to 2,000 ft. on the hills. It is fairly common.

87. *Chilades laius*, Cramer.

Rare.

88. *Cyaniris akasa*, Horsfield.

Fairly common over 3,000 ft. on the hills.

89. *Cyaniris puspa*, Horsfield.

I have only taken the form of the male which has no white on the disc.

90. *Cyaniris albidisca*, Moore.

I have not taken this, but it is recorded from the Annamalai hills.

91. *Cyaniris limbatus*, Moore.

Not common.

92. *Zizera otis*, Fabricius.

Very common in the low country in grass.

93. *Azanus gamra*, Lederer.

Rare. I have only taken one specimen near Trevandrum in March, 1888.

94. *Talicada nyseus*, Guérin.

Very common in the low country, and up to 2,500 ft. on the hills.

95. *Everes argiades*, Pallas.

Fairly common in the low country.

96. *Nacaduba macrophthalma*, Felder.

Fairly common.

97. *Nacaduba atrata*, Horsfield.

Fairly common in the low country and in the hills.

98. *Nacaduba ardates*, Moore.

Both the tailed and tailless forms occur on the hills at low elevations.

99. *Nacaduba dana*, de Nicéville.

I have only one specimen of this taken in January, 1890, in the low country, which Mr. Hampson identified for me.

100. *Jamides bochus*, Cramer.

Not common on the hills.

101. *Lampides elpis*, Godart.

Very common in the low country and in the hills.

102. *Lampides ælianus*, Fabricius.

Equally common with the last.

103. *Catochrysops strabo*, Fabricius.

Common in the low country.

104. *Catochrysops cnejus*, Fabricius.

Not common.

105. *Catochrysops pandava*, Horsfield.

Rare. I have only taken one specimen each of the dry and wet-season forms.

106. *Castalius rosimon*, Fabricius.

Common in the hills.

107. *Castalius ethion*, Doubleday and Hewitson.

Not so common as the last.

108. *Castalius decidia*, Hewitson.

Not common.

109. *Polyommatus bæticus*, Linnæus.

Very common in the low country.

110. *Amblypodia naradoides*, Moore.

Male not common, female rare. I have two specimens from the hills and two from low country.

111. *Iraota timoleon*, Stoll.

Fairly common in the low country in June. I have not taken *Iraota mæcenas*, which Mr. de Nicèville appears to think is the dry-weather form.

112. *Surendra quercetorum*, Moore.

Fairly common on the hills. This agrees with the measurements of Moore's *S. discalis*, but the "pale ochreous discal area" is by no means prominent in the female.

113. *Arhopala centaurus*, Fabricius.

Common in the low country from December to April, *i.e.*, throughout the dry-season.

114. *Arhopala amantes*, Hewitson.

Not so common as the last, taken in the low country in May and June.

115. *Arhopala canaraica*, Moore.

Not common. I have taken three specimens, one in October, one in November, and one in June near Trevandrum.

116. *Curetis arcuata*, Moore.

I have one specimen taken near Trevandrum in August, 1890.

117. *Curetis bulis*, Doubleday and Hewitson.

I have taken one male in the hills and two near Trevandrum, which I take to be this species. The females of this and the last I cannot discriminate. I have not taken the ochreous form of the female.

118. *Zesius chrysomallus*, Hübner.

Fairly common about Trevandrum in June and July.

119. *Camena cleobis*, Godart.

I have only taken one male on the hills.

120. *Aphnæus vulcanus*, Fabricius.

Common in the low country in June.

121. *Aphnæus lohita*, Horsfield.

Common. The markings on the underside vary considerably.

122. *Aphnæus concanus*, Moore.

Not uncommon in the low country.

123. *Tajuria indra*, Moore.

Fairly common in the low country from October to December.

124. *Tajuria maculata*, Hewitson.

I received one specimen of this from Mr. Garrett, a planter, who took it on the hills near Ponmudi, at 1,000 ft. elevation, in 1879.

125. *Tajuria longinus*, Fabricius.

Fairly common in the low country in June, July and August. I have also taken it in February.

126. *Tajuria jehana*, Moore.

Rare. I have only taken one specimen, a male near Trevandrum, in June, 1888.

127. *Zeltus etolus*, Fabricius.

Fairly common in the low country in June and again in November.

128. *Cheritra jaffra*, Butler.

Not uncommon in the hills from 2,000 ft. upward.

129. *Rathinda amor*, Fabricius.

Common in the low country from April to July.

130. *Catapæcilma elegans*, Druce.

Rare. I have only taken one specimen near Trevandrum in February, 1890.

131. *Loxura surya*, Moore.

Common about the foot of the hills up to 1,000 ft.

132. *Deudorix epijarbas*, Moore.

Common in the low country in the rainy season.

133. *Rapala schistacea*, Moore.

Common in the low country in both seasons.

134. *Rapala lankana*, Moore.

Rare. I have taken one specimen in October, 1889, and another in June 1890, near Trevandrum.

135. *Rapala lazulina*, Moore.

Rare. I have taken one specimen in June, 1888, and another in November, 1890, near Trevandrum.

136. *Rapala melampus*, Cramer.

Rare.

137. *Bindahara sugriva*, Horsfield.

Fairly common near Trevandrum in the wet season.

138. *Virachola isocrates*, Fabricius.

Not common. I have only taken it in June in the low country.

139. *Virachola perse*, Hewitson.

Rare. I have only taken one female and two males near Trevandrum.

140. *Sinthusa chandrana*, Moore.

I have taken two males on the hills in South Travancore in 1880.

Family PAPILIONIDÆ.

Subfamily PIERINÆ.

141. *Leptosia xiphia*, Fabricius.

Not common. I have only taken it in the hills.—1,000 to 4,000 ft.

142. *Terias hecabe*, Linnæus.

Form *hecabeoides*, Ménétriés.
,, *æsiope*, Ménétriés.
,, *excavata*, Moore.
,, *swinhoei*, Butler.

Common both in the low country and the hills.

143. *Terias libythea*, Fabricius.

Form *drona*, Horsfield.
,, *rubella*, Wallace.

Hills 2,000 to 4,000 ft.

144. *Terias læta*, Boisduval.

This has been sent to me from Pirmerd.

145. *Catopsilia catilla*, Cramer.

146. *Catopsilia crocale*, Cramer.

Found in abundance together in the dry-weather in the low country and up to 2,000 ft. on the hills.

147. *Catopsilia gnoma*, Fabricius.

148. *Catopsilia pyranthe*, Fabricius.

Common in the low country and in the hills. These two species are doubtfully distinct.

149. *Hebomoia glaucippe*, Linnæus.

Common at the foot of the hills.

150. *Callosune eucharis*, Fabricius.

Form *pseudevanthe*, Butler.

I have only received this from the high range.

151. *Colias nilagiriensis*, Felder.

This is only found on the high range.

152. *Hyposcritia narendra*, Moore.

Very abundant from 2,000 ft. upwards.

153. *Hyposcritia lalage*, Moore.

Taken on the eastern slopes of the hills.

154. *Catophaga paulina*, Cramer.

Common on the hills in January, February and March.

155. *Catophaga wardii*, Moore.

I have only received this from the high range.

156. *Catophaga galene*, Felder.

I have only received this from the high range.

157. *Appias hippoides*, Moore.

Rare, 2,000 to 4,000 ft.

158. *Appias vacans*, Moore.

Not uncommon in the low country, April to August.

159. *Huphina nama*, Moore.

Rare.

160. *Huphina phryne*, Fabricius.

Common in the low country and in the hills.

161. *Huphina remba*, Moore.

Rare. I have only two specimens, one taken in the hills, the other near Trevandrum in July, 1888.

162. *Belenois mesentina*, Cramer.

Not common. 2,000 to 4,000 ft.

163. *Nepheronia fraterna*, Moore.

Fairly common in the low country.

Moore records *N. ceylonica* and *N. fraterna* from Ceylon, and figures the male and female of the latter species. The chief difference between the two is that the male of *N. fraterna* has a comparatively narrow black marginal border, the underside is of a greenish-pearly-white, the hindwing is immaculate; it is also said to be smaller than *N. ceylonica*. Male, $2\frac{3}{8}$; female, $2\frac{3}{8}$. *N. ceylonica* is described as having the underside nacreous-blue: forewing with the costa and apical margin dusky cyaneous, the veins from base to near their end black, the median branches crossed by a confluent black streak: hindwing with a marginal row of very indistinct white spots with dusky borders. Expanse—male, $2\frac{6}{8}$; female, 3 inches.

The Travancore specimens agree with *N. fraterna* in having a narrow black border; the underside of some may be described as greenish-pearly-white, of others as nacreous-blue.

They agree with *N. ceylonica* in having the underside costa and apical margin of forewing dusky cyaneous, but the median branches are not crossed by a confluent black streak. The hindwing is not immaculate, but has a row of more or less distinct white spots with dusky borders. Their size varies from $2\frac{1}{2}$ to 3 inches in the male, the female $2\frac{3}{4}$ to 3 inches. Whether they should be called *N. ceylonica* or *N. fraterna*, or whether these two are distinct species, it is beyond me to decide.

164. *Nepheronia pingasa*, Moore.

Not uncommon in the hills, 1,000 to 3,000 ft.

165. *Nepheronia gæa*, Felder.

Rare; two males and one female taken near Trevandrum.

The females of these two species can be readily discriminated, as that of the latter has the discoidal cell in the hindwing and the submedian interspace for two-thirds of its length yellow on the upperside. There are two types of male, one of which has a very broad black marginal border, the underside white with a bluish tinge, and the veins broadly brown; both wings have a dusky brown border, with a marginal row of distinct bluish spots. This I take to be *N. gæa*.

The other has the underside white with a yellowish tinge, the veins on the hindwing are very narrowly marked, the marginal spots on the hindwing are indistinct, and there are none on the forewing. Except that it is not nacreous-blue, the underside answers to the description of that of *N. ceylonica* exactly.

This is the *Nepheronia* that is fairly common on the hills.

166. *Delias eucharis*, Drury.

Very common in the low country and up to 3,000 ft. on the hills.

Subfamily PAPILIONINÆ.

167. *Papilio* (*Ornithoptera*) *minos*, Cramer.

Fairly common in the low country, and up to 4,000 ft. on the hills.[1]

168. *Papilio* (*Pathysa*) *antiphates*, Cramer.

Rare. I have only taken two specimens in open forest at the foot of the Ashambu hills in August, 1879. Mr. Garrett took some near Ariankâvu.

169. *Papilio* (*Pathysa*) *nomius*, Esper.

Rare. I have only taken one specimen at the foot of the Ashambu hills.

170. *Papilio* (*Dalchinia*) *teredon*, Felder.

Common in the low country, and up to 4,000 ft. in the hills on the south; common also on the high range.

171. *Papilio* (*Zetides*) *doson*, Felder.

Not common, found only on the hills from 2,000 ft. upwards.

172. *Papilio* (*Zetides*) *agamemnon*, Linnæus.

Very common in the low country and in the hills.

173. *Papilio* (*Orpheides*) *erithonius*, Cramer.

Common in the low country and in the hills.

174. *Papilio* (*Iliades*) *polymnestor*, Cramer.

Common, more so in the low country than in the hills.

175. *Papilio* (*Charus*) *helenus*, Linnæus.

Common in the hills from 2,000 ft. upwards.

176. *Papilio* (*Laertias*) *pammon*, Linnæus.

Common in the low country and up to 2,000 ft. on the hills. The three forms of the female occur.

177. *Papilio* (*Menelaides*) *aristolochiæ*, Fabricius.

Common in the low country and the hills.

178. *Papilio* (*Menelaides*) *hector*, Linnæus.

Very common in the low country and on the lower slopes of the hills.

179. *Papilio* (*Menelaides*) *pandiyana*, Moore.

Abundant in the hills at about 2,000 ft., found also in the low country at the foot of the hills.

180. *Papilio* (*Chilasa*) *dissimilis*, Linnæus.

Fairly common in the low country, less so on the hills.

181. *Papilio* (*Chilasa*) *clytia*, Linnæus.

Not uncommon on the hills.

182. *Papilio* (*Chilasa*) *dravidarum*, Wood-Mason.

Fairly common in the low country, less so on the hills.

183. *Papilio liomedon*, Moore.

I have taken six specimens of this butterfly. I have seen it oftener in the low country than on the hills; of those taken, all but one were more or less damaged.

Family HESPERIIDÆ.

184. *Badamia exclamationis*, Fabricius.

Low country, common.

185. *Ismene jaina*, Moore.

I have only received this from the high range, where it appears to be common in April and May.

186. *Hasora badra*, Moore.

Rare. One specimen only taken near Trevandrum in November, 1889.

187. *Parata chromus*, Cramer.
Fairly common both in the low country and on the hills.

188. *Parata alexis*, Fabricius.
Rare. One specimen only from Pirmerd.

189. *Baracus vittatus*, Felder.
One specimen received from the high range, April, 1890.

190. *Astictopterus subfasciatus*, Moore.
I have taken this both in the low country and on the hills in August in the former, and in December in the latter.

191. *Astictopterus salsala*, Moore.
Fairly common in the low country in February, March and April.

192. *Matapa aria*, Moore.
Fairly common in the low country in July. One specimen I have taken in September.

193. *Gangara thyrsis*, Fabricius.
Common in the low country in June and July.

194. *Parnara narooa*, Moore.
Not common. I have only taken it in the low country.

195. *Parnara toona*, Moore.
Rare.

196. *Suastus gremius*, Fabricius.
Common in the low country at all times.

197. *Chapra mathias*, Fabricius.
Common in the low country and up to 3,000 ft. in the hills.

198. *Telicota bambusæ*, Moore.
Common in the low country in March and April, and up to 3,000 ft. in the hills.

199. *Padraona pseudomæsa*, Moore.
Rare.

200. *Padroana mæsoides*, Butler.
Low country, not common.

201. *Ampittia maro*, Fabricius.
Fairly common in the low country in November.

202. *Taractrocera mævius*, Fabricius.
Not common. I have only two specimens, both taken near Trevandrum. one in March, 1888, one in November of the same year.

203. *Aëromachus jhora*, de Nicéville.
Only one specimen taken on the hills.

204. *Aëromachus obsoleta*, Moore.
Two specimens only taken on the hills.

205. *Halpe ceylonica*, Moore.
Rare.

206. *Hyarotis adrastus*, Cramer.

Rare. One specimen only taken on the hills in South Travancore.

207. *Tagiades atticus*, Fabricius.

Common in the low country and up to 3,000 ft. in the hills, June, July and August.

208. *Tagiades distans*, Moore.

Common in the low country in June and July.

209. *Tagiades obscurus*, Mabille.

Not common; found only on the hills, 2,000 to 4,000 ft.

210. *Sarangesa dasahara*, Moore.

Not common, found in the low country and at the foot of the hills.

211. *Udaspes folus*, Cramer.

Fairly common in the low country in June and July; found also on the hills.

212. *Notocrypta alysos*, Moore.

Fairly common in the low country and on the hills up to 3,000 ft.

213. *Notocrypta restricta*, Moore.

Has the same distribution as the last.

214. *Notocrypta basiflara*, de Nicéville.

The first specimen I had of this was given to me by Mr. A. Macgregor, who took it on Pirmerd. I have since taken four specimens near Trevandrum, one in July, 1890, and three in September of the same year.

215. *Celænorrhinus leucocera*, Kollar.

Fairly common on the hills, 2,000 to 4,000 ft.

216. *Coladenia dan*, Fabricius.

Low country and hills in the cold weather; fairly common.

217. *Coladenia indrani*, Moore.

Fairly common in the low country in June and July. I have also taken it in October.

218. *Abaratha ransonneti*, Felder.

Fairly common in the low country and on the hills.

219. *Odontoptilum sura*, Moore.

Not uncommon on the hills; I have also taken it near Trevandrum rarely.

220. *Hesperia galba*, Fabricius.

Not uncommon in the low country in September and October.

DESCRIPTION OF A NEW SPECIES OF LIZARD OBTAINED BY MR. H. S. FERGUSON IN TRAVANCORE, SOUTHERN INDIA.

BY G. A. BOULENGER.

(*Read before the Bombay Natural History Society on 8th December, 1891.*)

LYGOSOMA SUBCÆRULEUM, *Sp. n.*

SECTION *Keneuxia.* Habit lacertiform; the distance between the end of the snout and the fore limb contained once and one-fourth in the distance between axilla and groin. Snout rather elongate, obtusely pointed, much depressed. Lower eyelid scaly. Nostril pierced in the middle of a small nasal; a supranasal, not in contact with its fellow; frontonasal a little broader than long, in contact with the rostral; præfrontals forming a median suture; frontal only a little larger than the interparietal, in contact with the first and second supraoculars; four supraoculars, second largest; nine supraciliaries; frontoparietals and interparietal distinct, subequal, the latter separating the parietals; a pair of nuchals; four labials anterior to the subocular. Ear opening very small. 28 scales round the middle of the body, dorsals feebly striated and a little larger than ventrals. Digits moderately elongate, with strong sharp claws, the basal phalanges somewhat depressed, the distal strongly compressed. Subdigital lamellæ smooth, 14 under the fourth toe. Bronzy olive above, with small whitish black-edged spots; a dark streak from the eye to the shoulder, and a pair of black streaks on the back of the head and nape; lower parts blue.

Total length	Millim.	120	Fore limb......	Millim.	18
Head	,,	15	Hind limb......	,,	23
Width of Head...	,,	8	Tail	,,	60
Body	,,	45			

A single specimen from Bodanaikanur, Travancore, presented to the British Museum by Mr. H. S. Ferguson.

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DESCRIPTION OF A NEW SPECIES OF FROG OBTAINED BY MR. H. S. FERGUSON IN TRAVANCORE, SOUTHERN INDIA.

By G. A. Boulenger.

(Read before the Bombay Natural History Society on 8th December, 1891.)

Ixalus travancoricus, *Sp. n.*

Snout rounded as long as the diameter of the orbit; canthus rostralis obtuse; loreal region slightly concave; nostril much nearer the end of the snout than to the eyes; interorbital space broader than the upper eyelid; tympanum hidden. Fingers free; toes one-third webbed; disks well developed; metatarsal tubercle flat, very indistinct. The tibio-tarsal articulation reaches the eye. Skin smooth, granular on the belly and under the thighs. Cream-colour above, minutely dotted with black; some larger black dots scattered on the back and on the tibia; a black streak from shoulder to shoulder round the snout, passing through the eyes and the nostrils; a blackish streak on each side of the anterior half of the back; a narrow band or pigment along the upper surface of the femur; belly white; the other parts colourless.

From snout to vent 31 millim.

This species is described from a single specimen, a gravid female, obtained by Mr. H. S. Ferguson at Bodanaikanur, Travancore, at the foot of the hills on the Eastern side in May, 1891.

ON THE VALUE OF THE PLANT PANGALA (*POGOSTEMON PARVIFLORUS*) IN CASES OF BITES BY THE PHURSA SNAKE (*ECHIS CARINATA*).

By Brigade-Surgeon W. Dymock (Retired).

(*Read before the Bombay Natural History Society on 8th December*, 1891.)

Pogostemon parviflorus, *Benth*, is a plant of the subtropical Himalayas and Deccan Peninsula. It hardly differs from *P. purpurascens*, and is very closely related to *P. plectranthoides*, *P. glaber*, and the variety *suaveis* of *P. Patchouli*. It does not appear to be mentioned by Sanskrit medical writers, but has a popular reputation as a styptic, and the leaves when bruised are in general use in the Concan as an application to wounds and sores. It is a stout, erect, branched, shrubby plant; glabrous, pubescent, or scaberulous. Leaves long-petioled, ovate or ovate-lanceolate, singly or doubly crenate-toothed or serrate, base cuneate, whorls subglobose, in dense cylindric or one-sided softly hairy spikes, bracts elliptic-ovate, exceeding the hirsute calyx, calyx-teeth short, triangular-lanceolate, ciliate. Nutlets very small, black, shining. The whole plant has a strong disagreeable black currant odour. Roots woody, knotted; bark light brown, scabrous, with an odour like that of the plant, and a pungent taste, benumbing the tongue and palate when chewed.

The Marathi name पागळा (pángala), पागूळा (pángúla), or पिंगूळा (pingúla), which also signifies the offensive smelling brown tree-bug, appears to have been given to it on account of its pungent odour.

In the Ratnagiri district of Western India the root has long been in use amongst the natives as a secret remedy for the bite of the Phúrsa snake, and in February, 1871, Mr. H. B. Boswell, the Collector, addressed the Civil Surgeon in the following terms:—"I have the honour to send you a specimen of a root which I have reason to believe to be a cure for the bite of the Phúrsa snake, and I shall feel very much obliged to you if you can in any way ascertain its medicinal properties and its effect on any one so bitten.

"It is said to stop all the after ill-effects of this poisonous bite, which is more than Liquor ammoniæ will, I believe, often do. The patient is to eat as much of it, after it has been washed, as would make in bulk the size of the first joint of one's first finger. This he is to do three times a day for seven days. It is also to be applied externally to the wound. I cannot, of course, vouch for the truth of this, or the efficacy of the cure, but one of my sepoys, who was bitten by a Phúrsa a week ago, has been doctored by the *Patel* (village headman) of this place, in this manner, and is now apparently well. The *Patel*, after much persuasion, has shewn me the root and the plant, one I know well, but the name of which I am not at liberty at present to mention. He also assures me that this is all he uses."

The plant was forwarded in April 1871 to the Chemical Analyser to Government, who identified it as species of *Perilla*, and expressed an opinion that it was highly improbable that a plant belonging to the *Labiatæ* would prove to be a specific for snake-poisoning, and suggested that some trustworthy evidence of its value should be obtained before he undertook an analysis. In June of the same year, Dr. C. Joynt, the Civil Surgeon, reported the following case:—"A sepoy, aged 27, was admitted on the night of the 29th. Liquor ammoniæ was applied to the wound after incising; next morning there was hæmorrhage from the wound, and also free hæmorrhage from the gums and tongue, the blood escaping had a bright arterial hue. A scruple of the root was ordered three times a day. The first dose decidedly relieved the vertigo which he complained of, and next day there was a marked diminution in the hæmorrhage from gums and tongue, which entirely ceased on the fourth day. No other medicine was given." Dr. Joynt remarked:—"The employment of the root in this case appears to have been singularly beneficial, and to deserve further investigation."

Unfortunately Dr. Joynt left Ratnagiri shortly afterwards and was unable to continue his investigations. In the Annual Report of the Ratnagiri Police Hospital for the year 1873-74 the following remarks by Dr. E. H. R. Langley, the Civil Surgeon, occur:—

"Snake-bites furnished two cases; these injuries were caused by snakes called 'Phúrsa' by the natives (*Echis carinata* of ophiologists). A rapid cure was effected by the internal administration, together with local application of the root of a shrub, 'the *Pogostemon purpuricaulis*,' very common all over the Concan." In 1874 Dr. Langley made the following report to the Deputy Surgeon-General:—"Thirteen cases arising from the bites of poisonous snakes were treated in the Civil Hospital, Ratnagiri. The only remedy used was the pounded root of a plant called *Pangala*, the '*Pogostemon purpuricaulis* of botanists'; the root of this plant is given internally as well as applied as a paste locally; all these cases did well, and were discharged from two to four days after admission."

In 1884, Dr. H. McCalman, Civil Surgeon, Ratnagiri, forwarded a communication, "*On the treatment of Phúrsa bite by Pangala root, with illustrative case,*" to the Bombay Medical and Physical Society, from which I extract the following remarks:—"The *Echis carinata*, a viperine snake, is very common in the Ratnagiri District. Fayrer describes it as fierce, active and aggressive, always on the defensive, and ready to attack. The bite is eventually highly dangerous, although the symptoms may be slow in developing. In fatal cases, death usually occurs in from 4 to 6 days, and is preceded by giddiness, great lethargy and depression, hæmorrhagic discharges, albuminuria, and occasionally lockjaw. * * * Pangala root, chewed in a fresh state, has been used for some years by Drs. Joynt, Langley, Barker and myself in the treatment of Phoorsa bite, and with invariable success."

The following is Dr. McCalman's illustrative case:—Rowjee Balsawant, Hindoo, police constable, aged 45, was admitted to hospital on the 14th June, 1884, at 6 A. M. An hour previously he was bitten on the dorsum of the foot by a Phoorsa snake, afterwards recognized and killed. He was immediately given Pangala to chew and a poultice of the leaves applied locally. At 9 A. M. there was much pain in the part, œdematous swelling of the foot and ankle extending half-way up the leg, giddiness, a feeling of great depression and hæmorrhage (dark-coloured) from the gums, under surface of the tongue and buccal mucous membrane generally. The blood expectorated did not coagulate. This bleeding had begun at 6 A. M., an hour after the man had been bitten. Pulse 72, temperature 98 F., no dyspnœa. Finding the hæmorrhage unchecked by the remedy, some perfectly fresh root just dug up was substituted for that first given. The effect was soon apparent.

At 2 P. M. giddiness less, pulse 78, temperature 99, expression tranquil, urine dark-coloured, depositing a slight flocculent sediment, reaction acid, sp. gr. 1012, albumen to a considerable extent. Pain of the foot less.

6 P. M., bleeding from the mouth practically stopped, giddiness increased, pulse 72, temperature 99·4. Urine shews blood corpuscules under the microscope.

15th.—No hæmorrhage from the mouth; urine contains a considerable quantity of blood; vertigo less. Swelling of limb less. Pulse as yesterday and of fair volume.

16th.—No hæmorrhage whatever. No giddiness. Urine pale, no sediment, no albumen, sp. gr. 1008. Pulse 66. Stiffness of foot, but no real pain.

17th.—Swelling rapidly disappearing. No head symptoms. Urine very pale and plentiful, sp. gr. 1004.

18th.—Pangala omitted. His convalescence was uninterrupted, and he left the hospital on the 22nd perfectly well.

Dr. McCalman remarks:—"I do not pretend to explain the action of Pangala, that the remedy acts generally and physiologically is apparent from the early drying up of remote hæmorrhages (*e. g.*, bleeding from the urinary tract) and the relief of cerebral symptoms, effects due to a restoration of the natural state of the blood, and, through it, of the nervous centres. The drug may also stimulate organs concerned in the elimination of the poison. The subject is one which calls for further careful experimental research."

Through the courtesy of Surgeon-General Pinkerton I have been supplied with further extracts from the records of the Ratnagiri Civil Hospital which shew that Pangala root is still used with the same success in the treatment of Phúrsa bite. Only one fatal case is recorded, and in that the remedy was administered in the form of tincture instead of in the usual manner.

Mr. G. W. Vidal, C. S., in a letter to the *Bombay Gazette*, dated January 30th, 1890, states that the bite of the Phúrsa-snake is apparently fatal in about 20 per cent. of cases, and the action of the poison is slow. He says, "In collecting materials for an account of the snakes of Ratnagiri for the *Bombay Gazetteer*, I found (in 1878) records of 62 fatal cases treated at the Civil Hospital. These cases shewed that death occurred on an average in four and a half days, though in some instances patients had lingered up to twenty days." In 1855-56 Dr. Imlach, then Civil Surgeon of Shikarpur, in a description of the 'Kapar' (*Echis carinata*), published in the *Transactions of the Bombay Medical and Physical Society* (Vol. iii., New Series, p. 80), wrote that "a reference to police returns will shew that in by far the majority of cases serious injury and death have been caused by the bite of this species." In an article upon the "Venomous Snakes of North Canara" (*Journ., Nat. Hist. Soc. Bombay*, Vol. V., No. 1, p. 69), Mr. Vidal says:—"There is indeed no doubt that the *Echis* is a far more potent factor than any other venomous snake in swelling the mortality of the Bombay Presidency, and it is important that this fact should be more generally known and recognised than it has been hitherto. It is, of course, impossible to shew the exact percentage of the deaths from snake-bite for which the *Echis* is responsible. In the returns no attempt is made to discriminate the species to which the recorded deaths are attributable, and little, if any, reliance could be placed in the statistics even if such an attempt were made. But the conclusion stated above may, I think, be fairly drawn from the fact, which is very clear from the returns in their present shape, that in all those districts, where the *Echis* is known to abound, the average mortality from snake-bite is *markedly* high, while conversely, the mortality is insignificant in other districts where the *Echis* is either rare or absent. The following table, which I have compiled with some care and labour from the official returns for the eight years, 1878—85, shews the population, the actual average mortality, and the mortality *per mille* of each district in the Bombay Presidency:—

District.	Population by Census of 1881.	Average actual mortality from snake-bite, 1878 to 1885.	Average mortality *per mille*, 1878 to 1885.
Hydrabad	754,624	181·7	0·247
Thar and Parkar	203,344	48·7	0·239
Karachi	478,688	87·2	0·183
Ratnagiri	997,090	154·5	0·155
Thana	908,548	108·8	0·119
Panch Mahals	255,479	30·5	0·119
Shikarpur	852,986	72·8	0·085
Surat	614 198	41·5	0·067
Kaira	804 800	47·2	00·586
Broach	326,930	19·1	00·584
Upper Sind Frontier	124 181	6·7	0·053
Kolaba	381.649	19·8	0·052
Ahmedabad	856,324	39·6	0·046
Sattara	1,062,350	41·0	0·038
Kanara	421,810	16·0	0·037
Belgaum	864,014	30·2	0·034
Poona	900,621	18·6	0·020
Dharwar	882,907	17·6	0·019
Khandeish	1,237,231	23·1	0·018
Bijapur	638,493	11·0	0·017
Nasik	781,206	10·8	00·138
Ahmednagar	751,228	10·3	00·137
Sholapur	582,487	2·2	0·003

Thus three Sind districts and Ratnagiri, in all of which the *Echis* swarms in suitable localities, stand well at the top of the list with an average mortality, taking the four districts together, of ·205 per 1,000. On the other hand, in the last four districts on the list, *viz.*, Bijapur, Nasik, Ahmednagar and Sholapur, the combined average mortality *per mille* is only ·0118. In other words, only one man dies of snake-bite in about 100,000 in these Deccan districts, while in the *Echis*-ridden tracts one man dies in every 5,000. Daboias and kraits are probably nowhere so common in Western India as to have much appreciable effect on the mortality. But cobras are quite as common, I believe, in these Deccan districts as they are in Ratnagiri or Sind. This shews, I think, pretty conclusively that the *Echis*—and not the cobra, or any other venomous snake—is chiefly responsible for deaths from snake-bite in Bombay."

The roots of *P. parviflorus* have been examined by Dr. Warden, Prof. of Chemistry at the Calcutta Medical College, and well known in Europe for his important contributions to our knowledge of the chemistry of Indian plants. The most interesting principle detected in the root was an alkaloid, which I believe will prove to be a new discovery, and which Dr. Warden proposes to call *pogostemonine.* After repeated purification it was left as a yellow varnish with slightly bitter and mouse-like flavour. It was more soluble in chloroform than in ether. No special colour reactions were noted. He also detected the presence of *trimethylamine,* and a volatile principle with a cedar-wood odour. Resinous principles were also present, with astringent matter.

The constituents of the plant, which should be used in any future experiments, are the alkaloid pogostemonine and trimethylamine, the amount of tannic matters present being insufficient to account for any remarkable styptic properties. Trimethylamine ($C.\ H._{33}\ N.$) has been obtained from several plants, such as Beet, Arnica, and in this country from *Salvadora persica,* a plant which has a reputation in cases of Phúrsa-bite in Sind. Trimethylamine occurs also in herring-pickle, which contains it in considerable quantity and owes to it its peculiar disagreeable smell. Commercially, it is prepared from the residue left in the manufacture of beet-sugar. It is a colourless, strongly alkaline, caustic liquid, having a strong ammoniacal and offensive odour; applied to the skin it acts as an irritant like ammonia, causing burning and redness, and, if long continued, excoriation. It is said to have been given internally in France and Germany with some success as a remedy for rheumatism, but its offensive odour is a great drawback to its use as a medicinal agent. The chloride, which has no smell and little taste, has been suggested as the most convenient form for administration.

NOTES ON THE MAMMALIA OF SOMALI LAND.

By J. D. Inverarity.

(Read before the Bombay Natural History Society on 1st September, 1891.)

With Six Plates.

There is a considerable variety of animal life in the Somali country, and it is the object of these notes to give a short account of the animals I met with in two sporting expeditions I made there. The first, in 1889, was cut short at the end of a fortnight by a misadventure, the second, in 1890, occupied two months.

In the part of the country I was in there was no agriculture whatever. The different tribes are nomads and wander about their respective territories with their flocks of sheep and goats and herds of cattle and camels to wherever they find pasture. The presence of these flocks is detrimental to sport among the antelopes, but on the other hand they are a source of attraction to the lion, and I found that the best ground for lions was in the neighbourhood of Somali encampments.

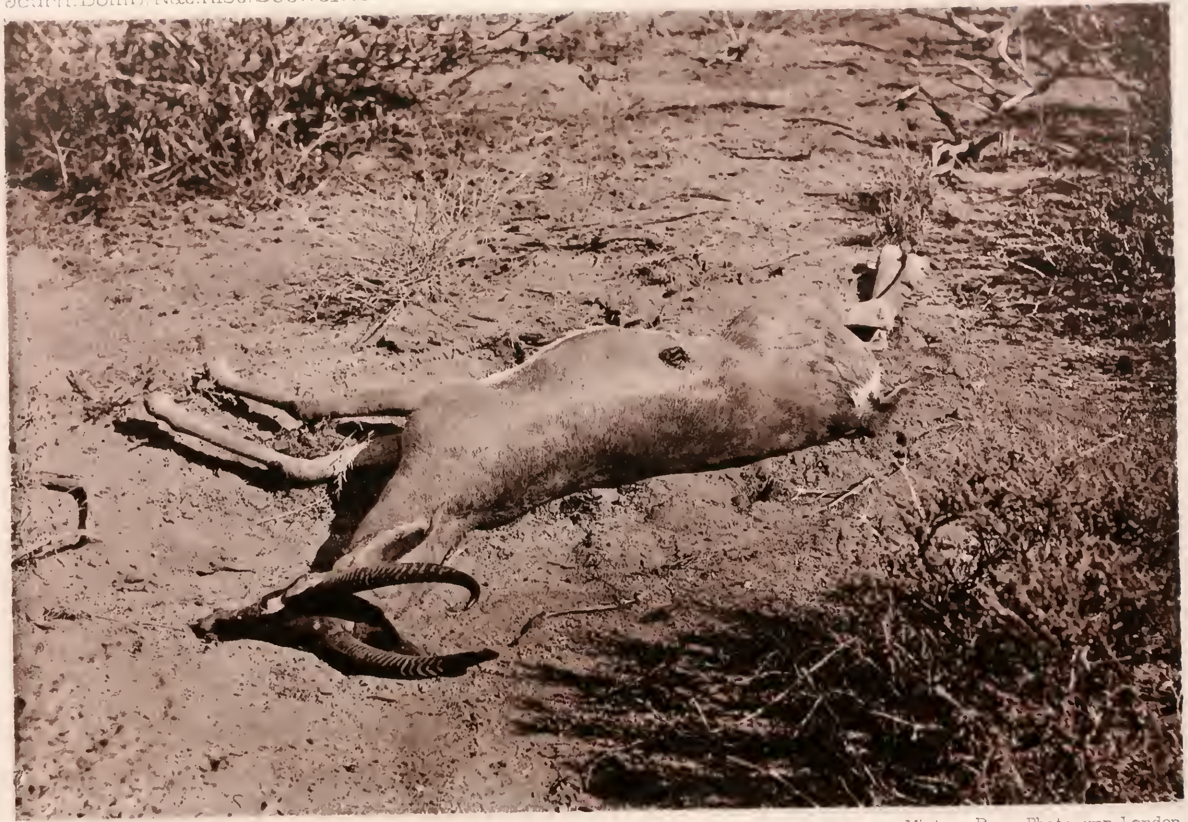
I was fortunate in getting good specimens of almost all the animals which are found within a hundred miles of the coast. They comprised the following:—

	English name.	Somali name.
1. Gazella walleri	Waller's Gazelle	Gerenook.
2. Gazella sœmmerringii.	Sœmmerring's Gazelle ...	Awal.
3. Gazella naso	Gazelle	Dhero.
4. Neotragus sp.............	Sand Antelope	Dik-Dik.
5. Strepsiceros kudu	Koodoo	Godir.
6. Strepsiceros imberbis...	Lesser Koodoo..............	Anderio.
7. Oryx beisa	Oryx	Berid.
8. Oreotragus saltatrix ...	Klipspringer..................	Alakud.
9. Equus(asinus)somalicus	Wild Ass	Duber, Dibhuded.
10. Phacochœrus sp.	Wart Hog......................	Dophur.
11. Hyæna crocuta	Spotted Hyæna	Waraba.
12. Hyæna striata...........	Striped Hyæna	Lidder.
13. Felis leo	Lion	Libah,

There were three animals I did not shoot, *viz.*, the elephant (Somali "Marode"), the panther (Somali "Sheybelli"), and the hartebrest (Somali "Sik"). In the Ogadeen, further inland, the Somalis told me there were rhinoceros (Somali "Wheal"), and giraffe (Somali "Ghiri").

The above list looks rather imposing, but with the exception of lion, *Gazella naso*, and dik-dik, the largest number of any one animal I shot was three, and of some I shot only one specimen.

I shot no does except of *Gazella naso*. All the antelopes and gazelle were remarkably wild, and it was necessary to take much longer shots than one has to in India. I may mention that for about 30 or 40 miles after leaving the coast at Berbera, one crosses a desert in parts flat, thinly covered with mimosa bush, and in parts rugged sandstone hills almost devoid of vegetation. Here and there a wady or river bed, for the most part waterless, affords along its bank for 100 yards on either side thick cover of thorny bush. In this tract the three gazelles, the wild ass, the lesser koodoo, the dik-dik, wart hog, the two hyænas and an occasional lion will be found, the last named in the thick bush by the wadys. After about 30 or 40 miles you come to a range of mountains running east and west called the Golis, which are said at the highest point to be nearly 6,000 feet high. However, when you are at the foot of them, you have nothing like this to climb, as on your way from the coast you have, without knowing it, been gradually ascending the whole way. These hills are very stony and steep, and covered with thick bush, chiefly of a thorny description. They are broken up with deep ravines. In the hills are lion, koodoo, klipspringer, wart hog, the ubiquitous hyænas, and dik-dik. Elephants also inhabit this range of mountains. The northern side of the hills which you first reach is very precipitous. When you get over them, the southern slope is a comparatively easy descent, and when you are free of the hills you are on an extensive sandy plateau said to be 2,000 or 3,000 feet above sea level. It is capital ground for tracking. Here grows the umbrella mimosa, the branches at the root being about 3 or 4 feet in diameter, spring out at an angle from the ground, and at a height of 8 or 10 feet the top forms a level table 20 or more feet across, almost as smooth as if it had been trimmed by a gardener. Dense clumps of thorny bush with long grass 12 or 15



From a Photograph by J. D. Inverarity.

Mintern Bros. Photo. imp. London.

GAZELLA WALLERI.

feet high afford a secure retreat for lions; these clumps are pretty thickly scattered in open sandy ground thinly covered with thorn bush. I believe this plateau extends for about 200 miles, and no doubt the character of it varies at different places. There are hardly any trees in the Somali country. In the hills there are a few trees, chiefly Somali pine, but elsewhere you see none, except an occasional mimosa which looks just like the Indian babool.

The general configuration of the country is something like that of Western India, the flat country near the coast, the ghauts, and the elevated plateau on the top of the ghauts.

On the plateau all the animals I have mentioned are to be found, except elephant, koodoo, and klipspringer. I will now proceed to describe the animals I have myself procured.

Gazella walleri

Is at once recognizable by its peculiarly long neck and upper lip, which gives it the appearance of a miniature giraffe. They go in small herds of generally less than half a dozen, of which only one is a buck. Solitary bucks are common. The largest herd I saw consisted of nine individuals, including three good bucks, and this is the only occasion I saw more than one buck with a herd. Herds of a few does without a buck are also met with. They are very elegant animals with long slender legs; in colour brown, the belly and inside of legs white, along the back runs a broad band of dark brown, much darker than the rest of the body, 7 or 8 inches in width. As far as I could see with the glasses this band was not so dark in the does as it is in the bucks. A very good coloured representation of the skin and head is printed in the Proceedings of the Zoological Society of London, 1885, p. 538. The horns of the buck are strongly ringed for about three-fourths of their length; they bend outwards and backwards, curving in again towards the tips, which bend forward.

The measurements of three heads I have are as follows:—

	No. 1.	No. 2.	No. 3.
Length on curve along upper surface	14 inches	13 inches	12½ inches.
Straight line from base to tip	11 inches	11 inches	10¾ inches.
Between tips	3¾ inches	5 inches	2⅓ inches.
Round base	5½ inches	5¼ inches	4¾ inches.

The females are hornless. Except the newly discovered gazelle hereinafter mentioned, I believe this is the only African species of gazelle of which the females have no horns. This gazelle is found on the flat desert and in the low hills near the coast and also on the plateau. It is generally seen on ground where there is plenty of bush, although I have seen it out on the open desert near bush. It is quite common and difficult to stalk. It feeds chiefly on the bushes, and in my opinion seldom if ever drinks. The Somalis, although they eat all the other antelope except the klipspringer (and I am not quite sure they don't eat that), won't eat this gazelle; the reason given to me was a curious one and unfit for publication. The flesh is good. As pointed out by Sir Victor Brooke in the P. Z. S., 1878, p. 929, *Gazella walleri* differs from all other species of gazelle in the very great backward prolongation of the occiput, and in the shortness and width of its grinding teeth. The lower jaw, too, is more slender than one usually finds in gazelles. It has been made the type of a distinct genus under the name of *Lithocranius walleri* by Dr. Kohl. Mr. H. C. V. Hunter, who shot this gazelle on the Tana River to the south of the Somali country, told me the horns there were not so thick as those described above.

In the P. Z. S., 1891, p. 207, a new gazelle, recently discovered in Somali land, is described under the name *Ammodorcas Clarkei*, of which the females are said to be hornless.

Gazella sœmmerringii

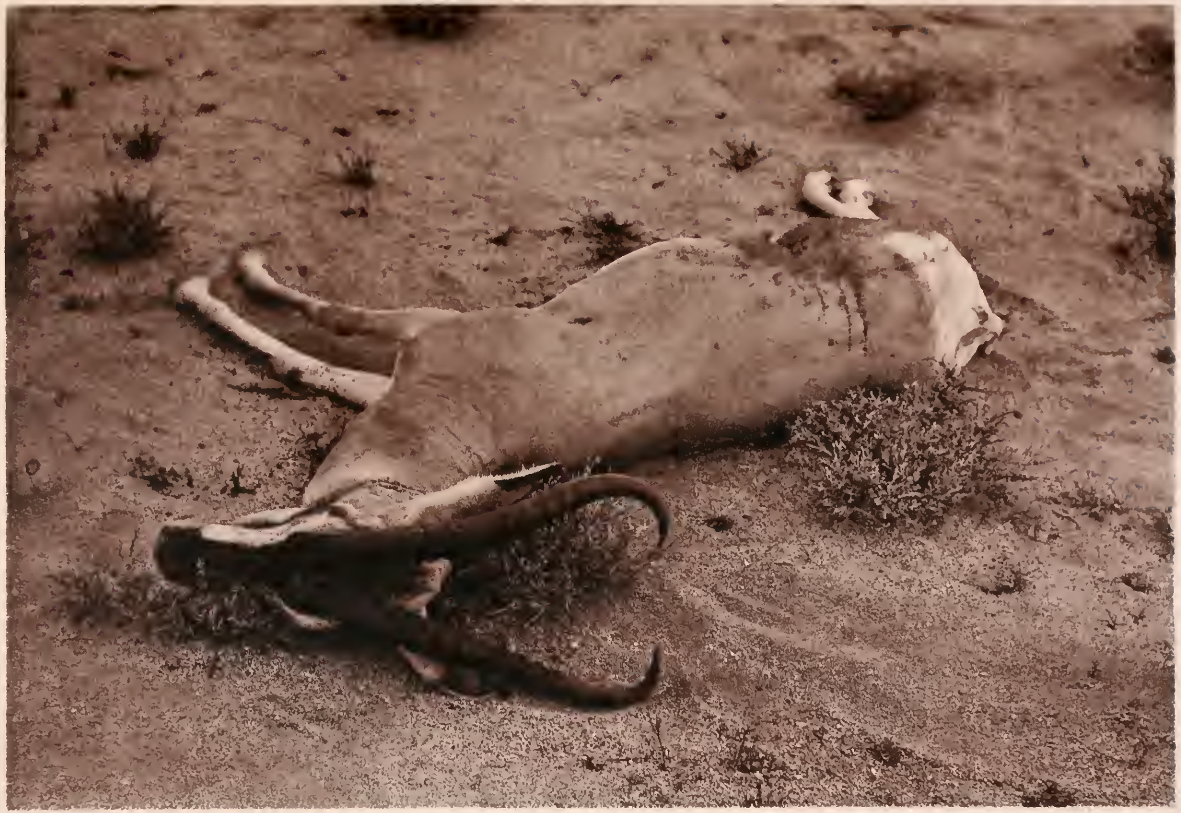
Is a much stouter built animal than *Gazella walleri*, and is of a pale fawn colour with under parts white. Its rump is pure white. It was not common in the part of the country I was in. In fact, I only saw one herd of six and a solitary buck, the latter I shot. I was told they were common on the Bulhar plain, a few miles west of the line I took, and that they are found in large herds. The horns are longer and thicker than those of *Gazella walleri*. The horns curve backwards, then outwards, and the tips curve in towards each other. The one head I have measures—

Length on curve along upper surface, 15½ inches.

Straight line from base to tip, 13 inches.

Between tips, 4 inches.

Round base, 5½ inches.



From a Photograph by J. D. Inverarity.

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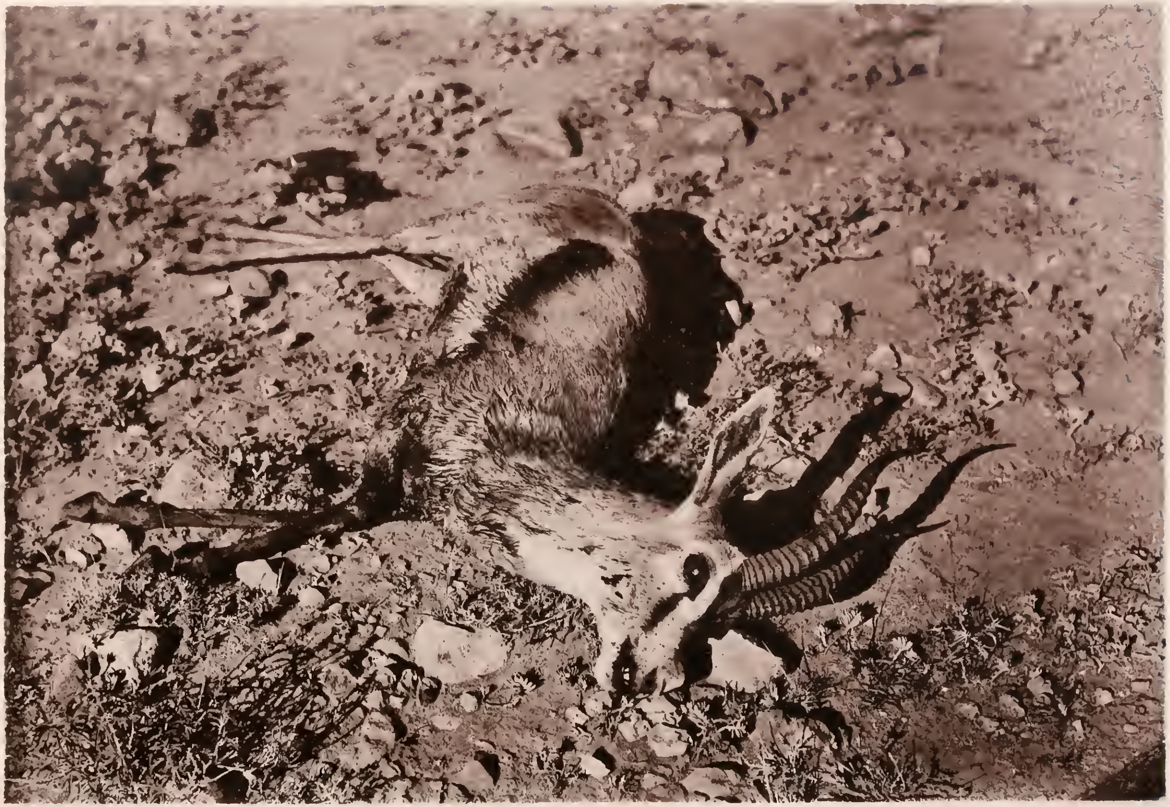
SŒMMERRING'S GAZELLE.

Gazella sœmmerringii.



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GAZELLA NAZO.

The owner of this head measured 2 ft. 10 in. at the shoulder. The horns are strongly ringed for about three-fourths of their length. This gazelle I believe sticks to the flat and is found both near the coast and on the plateau. The female has horns. My experience of this animal is too limited to warrant any further remarks.

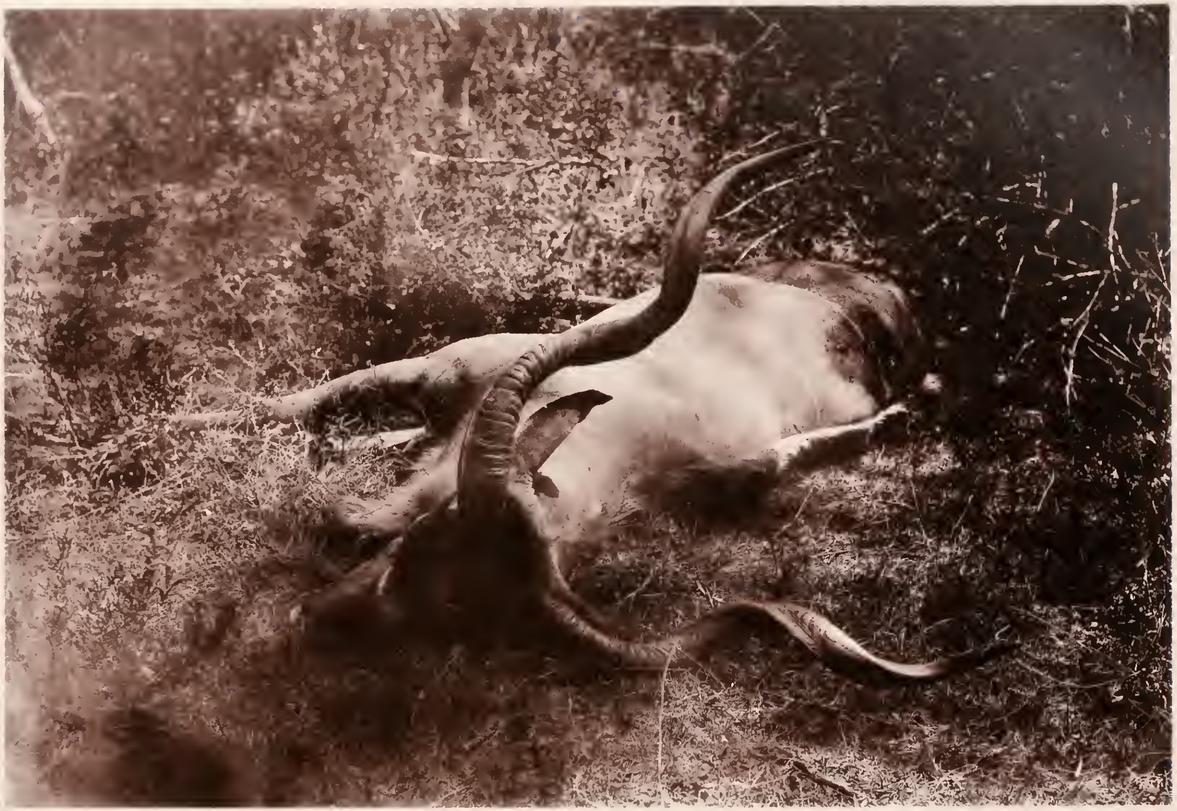
Gazella naso.

The buck in size and general appearance resembles the Indian Chinkara (*Gazella bennettii*). The does have much longer and thicker horns than the chinkara. *Gazella naso* takes its name from the loose pouch of skin it has on the upper surface of the nose. The skin is so loose that if you lay hold of it and pull it forward, it easily covers the upper tip. Both bucks and does have it.

A print of a buck's head is to be found in the P. Z. S. of 1886, evidently taken from a stuffed head. The stuffer apparently has stuffed this pouch out as if it were inflated, quite unlike anything I ever saw. I often watched *Gazella naso* through glasses, and never saw them inflate their pouch. I don't believe they do so. Mr. Sclater, in describing it in the P. Z. S., says, "I think there can be no question "of it belonging to an undescribed species which I propose to call "*Gazella naso*. *Gazella naso*, as its name implies, is sufficiently "distinguishable from all other known members of the genus, by hav-"ing the extremity of the snout above the nasal openings developed "into a large, flabby-wrinkled mass, which is scantily covered by "short hairs of a grey colour," a description taken from the aforementioned stuffed head, which does not accord with my views. I shot eleven of these gazelles, and in no case was there a flabby-wrinkled mass, nor was the skin scantily covered with grey hairs. The skin merely lies loose on the nose with no abnormal flesh or other substance beneath it, and is as well covered with the ordinary yellowish hair as any other part of the face; the skin being loose no doubt is wrinkled, but not so as to be very noticeable. In the photograph I took I pulled the loose skin up so as to show it, but it does not stick up like that in the living animal. It would be impossible I think to tell the buck's horns from those of a chinkara. The longest pair I shot measured 10 inches in a straight line from base to tip along the side, and 4 inches round the base. If you measure them in a straight line along the front they measure nearly an inch more. The longest doe's horns were 9 inches in a straight line, and 2½ inches round the base. This, however, I think is unusually long, 7½ inches being about the usual size. The horns of the female are slightly ringed for about two-thirds of their length. *Gazella naso* is found close to Berbera, and is common both near the coast and on the plateau. Mr. Phillips, in the P. Z. S. of 1885, p. 930, says the plateau gazelle seemed to him to differ from the one in the plains, being lighter and wanting the black mark along the side. I think they are exactly the same; I saw no difference in colour. The one photographed was shot on the plateau and has a broad black stripe along the side. On referring to two other photographs of doe gazelles shot on the plateau, I find one has a black stripe and the other has not; another of a buck shot within sight of Berbera, shows the black side mark. According to the P. Z. S., 1891, p. 210, there seems to have been a good deal of confusion about this gazelle, as it turns out to be the gazelle originally named *Gazella speekii*. All the gazelles I got on the plain near Berbera had the loose pouch of skin on the nose, and I saw none of the species without the pouch said to inhabit the Berbera plain identified in the P. Z. S. of 1891, p. 211, as *Gazella pelzelni*. However, I only marched straight through the Berbera plain and did not spend any time on it.

Neotragus sp.

Is a small antelope 9 inches high at the shoulder. It goes in pairs, and is found everywhere in the desert. It is too small to shoot with the rifle. On the forehead is a crest of long chestnut hair; the general colour of the body is grey; the skins vary a good deal in colour; some have a good deal of light-brown in them, while others are almost entirely silvery-grey; the legs are a light-brown on the outer sides, the inside of legs and belly whitish. The muzzle protrudes beyond the mouth. The female has no horns, and her crest is smaller than that of the male. The horns of the male are short, upright spikes, usually under 3 inches in length. The best pair I have out of 18 heads is just under 3 inches long. The lower half of the horns are marked by strong irregular sub-reticulated annulations. Some horns grow parallel to each other; in other cases they grow slightly towards each other, and then diverge again



From a Photograph by J. D. Inverarity

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THE KOODOO.

Strepsiceros kudu.

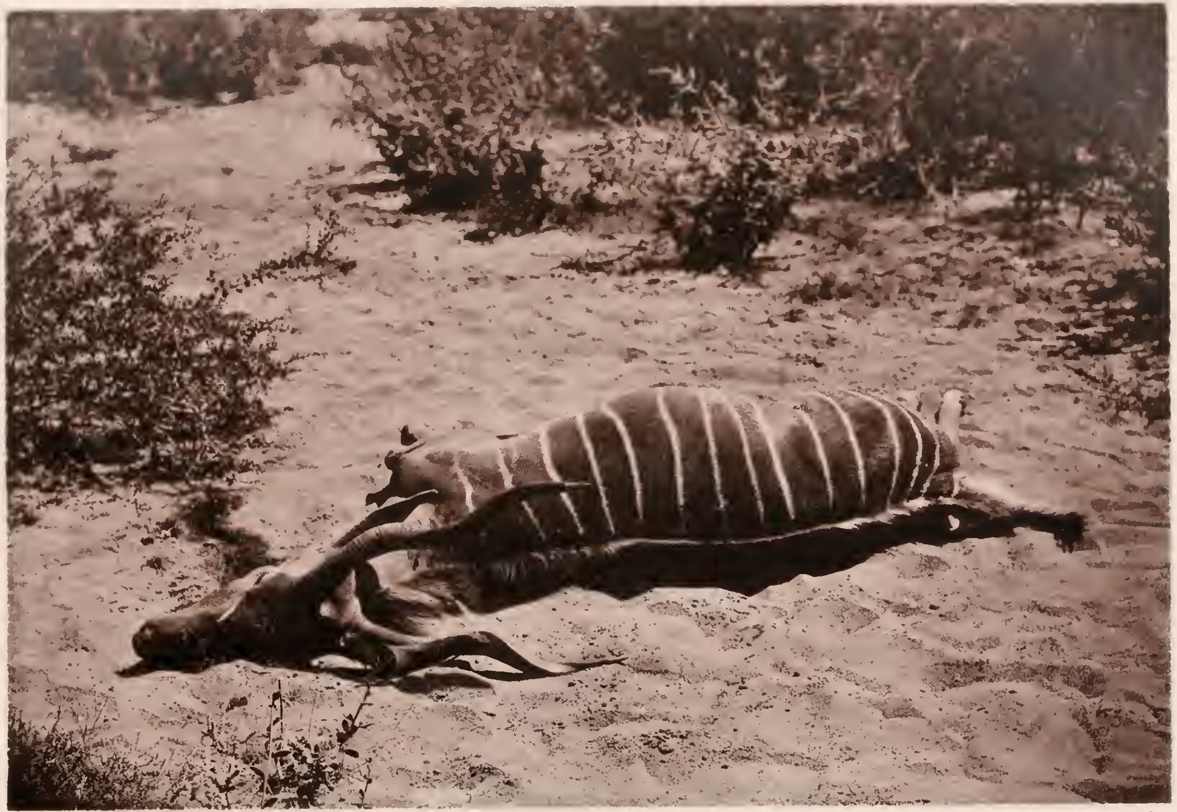
towards the points. The horns are peculiar in the way they are set on the head. The front edge of the horn, instead of directly facing you when you look at the skull, appears on the inner side, so that when taking a front view of the skull you really see almost a complete side view of each horn. I have not observed this in any other antelope or gazelle. A peculiarity of the skull, characteristic of this genus, is the excessive shortness of the nasal bones. They are easily killed with No. 3 shot. If they get up out of range, and the bushes are not too thick, you can often get a shot by running after them, as after the first bolt, they trot on, stopping at intervals. They are almost always found in pairs, and appear to be of an affectionate disposition, as if you shoot one, the other will often stop, reluctant to leave its comrade, and let you get quite close up before it runs away. I saw one accompanied by two young ones, so they appear to produce two at a birth. They feed on the bushes, and no doubt eat grass if they can get it. I don't think they drink. The meat is said to taste of musk, but I never noticed this myself.

I am not sure whether the Somali dik-dik is the same as the Abyssinian *Neotragus saltianus*, or the East African *Neotragus kirkii*. The difference between the two depending on certain dental and osteological distinctions are not very apparent to the unlearned. They are described in the P. Z. S., 1880, p. 17. The inner side of the horns in *N. saltianus* are said (in P. Z. S., 1891, p. 212) to be flattened along their inner side, and therefore triangular in section, while those of *N. kirkii* are rounded and therefore circular in section. Applying this test to the horns I have, some are flat along the inner side, while others are more or less rounded.

Strepsiceros kudu.

This antelope, in Somali Land at all events, is only found in the hills, though in other parts of Africa, according to Mr. Selous's book, they are found where there are no hills. The male is a handsome beast standing as high as a sambar, say 13½ hands, with long spiral horns something like those of a markor. In colour it is an iron grey with three white stripes down its sides and one across the quarters. A standing mane runs along the whole length of the back, the hair of which is longest on the neck and withers, and is of a white colour variegated with black. A long fringe of black and white hair clothes the whole length of the throat. The head is prettily marked with 3 white spots on each cheek (very like the spots on the cheeks of a bull nielgai), and two white lines, one from the corner of each eye, meet on the face. Mr. Selous says that the koodoo is marked with eight or nine white stripes. In Harris's Wild Sports of Southern Africa, it is described as having four or six lines on the side and four more over the croup, and in the picture of one in the list of the animals of the London Zoological Society (an uncommonly bad likeness), it is shown as having nine white stripes down the side. If these statements are correct, the Somali koodoo would appear to have a less number of stripes than the koodoo in South Africa. I shot two males, the largest of which is shown in the photograph, on which the stripes can easily be counted. I saw a good number of females at different times, but it was very difficult to observe them, owing to the thick character of the bush they were found in, but I am pretty sure that they did not have so many stripes as eight or nine, though I am not prepared to say that none had more than four. The females are of a yellowish-brown colour and are hornless. The young males are of the same colour as the females, but soon assume the grey colour. I saw one with small horns whose fore-quarters were grey while his hind-quarters were brown. I watched him for a long time on the bare side of a perpendicular hill, as I was particularly struck with his peculiar colour. His horns did not appear to be more than about a foot long.

Koodoo shooting is hard work. Owing to the precipitous character of the ravines in which they are found, and the denseness of the thickets, it is quite impossible to see any distance down the hill on the side you are stalking, and the only chance of a shot is when he bolts up the opposite side of the ravine. They go in small herds of half a dozen or less. The largest herd I saw was a dozen, of which eleven were females. The horns of the one photographed measure almost 3 feet from base to tip in a straight line, which is as good, I believe, as one can expect to get in Somali Land. Mr. Selous says the largest horns he ever saw measured were 3 ft. 8½ inches. The koodoo has no suborbital sinus. It feeds on both bushes and grass and drinks regularly, so I don't think you would ever find it at any great distance from water. Dr. Livingstone, however, mentions the koodoo



From a Photograph by J. D. Inverarity.

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THE LESSER KOODOO.

Strepsiceros imberbis.

as one of the antelopes that can exist without water. I procured a young male a few days old from some Somalis who had caught it. I got it alive to Berbera, but it died there. It was born in November; so some, at all events, breed at that season. There are a large number of ticks in the Somali country, and they appear to be partial to koodoo, as the whole of the belly of one I shot was a mass of ticks almost as close together as they could stick. The Somalis prefer koodoo meat to that of any antelope. To my taste all antelope venison is very much alike. The koodoo barks loudly when suddenly disturbed, something like a sambar's bark. I was stalking a small herd from below in some thick bush and they kept constantly barking; they turned out to be females, and did not see me until I was close on them, though their suspicions had been aroused.

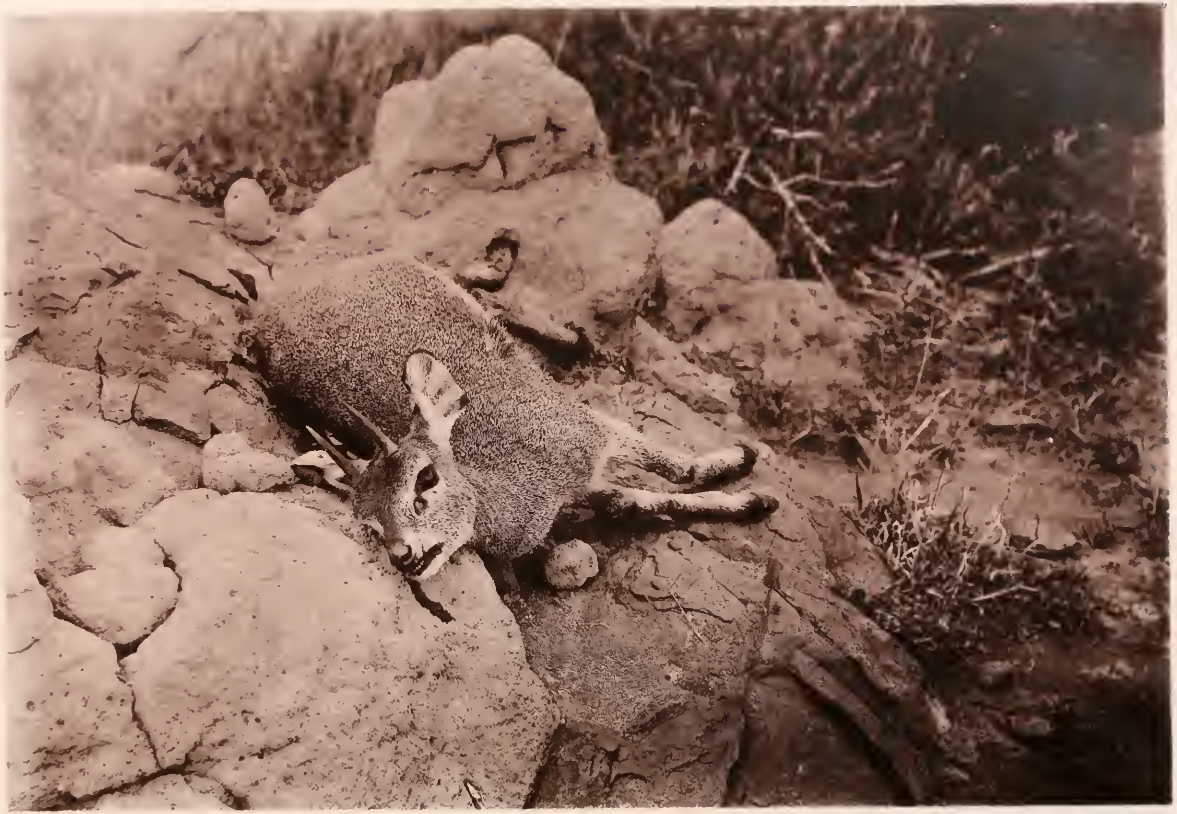
Strepsiceros imberbis

Is to my mind one of the prettiest antelopes. The buck is of a blue grey with numerous white stripes running down the whole length of the body (the one photographed has fourteen stripes from two to four inches apart). A standing mane of white hair runs along the neck and back to the tail, being shortest along the middle of the back. It has a white patch on the lower part of its neck, and the face is marked, like the koodoo, with white spots on the cheeks, and a white line from the corner of each eye across the nose. It has no fringe of hair on the throat, and has no suborbital sinus. The horns are spiral, of a less open twist than the koodoo's; the one photographed measures 21 inches in a straight line from base to tip. The piece broken out of the left horn was caused by one of my shots unfortunately hitting the horn. A pair of horns, in the possession of this Society, measures 24 inches from base to tip in a straight line. The females are hornless; they and the young males are of a yellowish-brown colour; the females are striped like the males, but, as far as I could see, the stripes were not as pure a white as those of the male. I was unable to count the stripes on the female, but they appeared to be numerous. This antelope frequents thick bush at the foot of the hills and in the flat desert. I don't think it is found in the hills or in the open. When disturbed in the thick bush they start off with a loud bark. I saw a young fawn in December. I saw a solitary buck, lesser koodoo, at least 30 miles from any water, which argues that, like many other African antelopes, it can go a long time without drinking. The Somalis told me that this and other antelope get the water they require by eating the aloe, the spikes of which are full of moisture, and I found in the stomach of an oryx that I opened, plenty of aloe. I did not measure, but should say the lesser koodoo stands about 3½ feet high.

Oryx beisa.

One objection to this animal is that the males and females have equally good horns, so that it is difficult to distinguish the fair sex in a stalk. The female's horns are not so stout as the males, but they are, as a rule, longer. The only one I fired at was a solitary male. He measured 3 feet 9 inches at the shoulder. His horns were an old worn pair 26½ inches long, 6¾ inches round at the base, and 8¾ inches between the tips. A good pair, however, would be about 40 inches long. They are cylindrical in shape and almost straight, strongly marked with rings for the lower-half of the horn. One horn is usually shorter than the other. The general colour is a greyish roan, and they are handsomely marked with a black bar along the lower part of the side and down the throat, a black bar across the foreleg, and a dark stripe along the back bone. The face is black and white ; a broad black stripe runs from the root of the horn to near the corner of the mouth (in this stripe is the eye), another black stripe runs from the root of the ear down the cheek across the jaw giving it the appearance of having a bridle on. A short mane stands on the neck and withers. The tail is long, and ends with a bushy black tuft which descends below the hocks.

They stand higher at the withers than at the croup. The eye is placed high in the head. Its long face, long tail, and drooping quarters prevent it having the game-like look of some of the previously described antelopes. It is a desert antelope, and can be easily tracked. Like all desert antelopes its hoofs are more narrow and pointed than the hill antelopes like the koodoo. It is said to be a favourite food of the lion, and to sometimes transfix the lion with its long pointed horns when attacked. I once, when tracking two lions,



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THE KLIPSPRINGER.

Oreotragus saltatrix.

came on a place where they had stalked two *Oryx*, but had failed to catch them. The sandy ground was torn up with the footprints of the lions and of the fleeing *Oryx*; the lions, however, appeared from the tracks to have given up almost immediately, as they had only gone fast for about 40 yards. The *Oryx* has no suborbital sinus. It is independent of water. The skin is used by the Somalis for making their shields. I was told that they ride them down.

A single horn is also used by them as a stabbing weapon in a fray, and I was told that one of the men of a native regiment was stabbed and killed with one in a night attack on a zereba in an expedition from Aden made at the end of 1889.

Oreotragus saltatrix.

This small hill antelope is occasionally met with in the Golis mountains. An old male I shot measures 18 inches at the shoulder, and 3 feet from tip of nose to end of tail. The hair is coarse and long. Each hair is tipped with yellow, a blackish-brown in the middle and lighter at the base, producing a colour very like that of a golden plover. The females are hornless. The horns of the males are short, stout, round spikes, straight and slightly inclined forward, between 3 and 4 inches long, and are slightly wrinkled at the base. The head is short and broad. The pasterns are very upright, and the cleft between the hoofs very long; the hoofs themselves are short and round. They go in pairs, and are found at the tops of the ridges of the hills, where the boulders of rock crop up out of the ground. When alarmed they utter a sound something like a loud sneeze. They seem to frequent the same spot. I saw a pair once low down in a ravine among the thick bush, but as a rule they keep in the neighbourhood of rocks. As far as I could make out, the Somalis don't eat the klipspringer. The one I shot fell dead and could not be *hallaled*, so they would not have eaten it anyhow, but I understood them to say they never eat the meat of this antelope.

Equus (asinus) somalicus.

This ass was first described in the P. Z. S., 1884, p. 540, where a coloured plate of one is also given. Mr. Sclater says: "The Somali ass differs from that of the Nubian Desert in its generally paler and more greyish colour, in the entire absence of the cross stripe over the shoulders, in the very slight indication of the dorsal line, and in the numerous black markings on both front and hindlegs;" and further on he describes it as "griseus; linea dorsali fere obsoleta, humerorum nulla; juba longiore, caduca; pedibus distincter et frequenter nigro fasciatis." This description, though no doubt correct for some specimens, does not apply to a female ass I shot near Berbera, as she had a black stripe on each shoulder, though neither stripe was complete, not extending to the dorsal line. The stripe on the off-side was more conspicuous than the one on the near-side. The dorsal line extended from the tail to half-way up the back. I got a good photograph of the ass, which clearly shows the shoulder stripe, and I have also preserved the skin. Wild asses are very difficult to get near. I had to take my shot at nearly 300 yards, from the top of one low hill to the top of another. The ass fell dead. Four others that were with it ran a short distance and then stood looking at the dead one. As I did not want to shoot another, I walked up without concealment, and, strange to say, the asses did not bolt till I was within 60 yards. The wild ass is the size of a galloway; the legs are white, barred with black stripes, the whole way down to the hoof. It has a short hog mane of black hair fringed with sandy hairs. The tuft to the tail is black. I saw them among bare rugged sandstone hills about 20 miles from the coast, and saw the tracks of an old and young one on the plateau. The tame Somali ass has very distinct shoulder stripes and dorsal line, and some of them have their legs barred with black stripes exactly like the wild one. They are much smaller than the wild ass. The flesh of the wild ass is like very good beefsteak. I never tasted better meat. The Somalis do not eat the flesh.

Phacochœrus sp.

Is somewhat smaller than the Indian boar, but has much finer tusks. The best boar's tusks I have measure as follows: The upper tusks 12 inches long round the curve, of which 10 inches on the outer curve and 9 inches on the inner curve project beyond the gums. The measurement in a straight line from tip to base is 8 inches. The lower tusks are 9½ inches round the curve, of which 6 inches project beyond the gums. From tip to base in a straight line measures 7 inches. It will be seen that the tushes curve very much less than those of the Indian boar. The upper tushes are massive, being solid ivory, for about 9 inches of their length, and $4\frac{3}{4}$ inches in circumference at the gums. They weigh $10\frac{1}{3}$ oz. and 10 oz. respectively. The two lower ones about $2\frac{1}{2}$ oz. each. The lower tushes are rather thicker than those of the Indian boar. The sow's tushes present as good an appearance as an Indian boar's. Her upper tushes being very like the lower tushes of the latter, and projecting 3 to 4 inches from the lip. The wart hog takes its name from the conical protuberances of skin on its face, which in the boar are four in number symmetrically placed, one on each side of the face between the eye and the mouth, and one on each side of the head behind the eye; the latter are the longest. These so-called warts when cut off close to the head appear to be only knobs of skin quite devoid of blood vessels. The sow I don't think has any of these warts. The boar has a long mane of coarse bristles from the top of the head along the back; those on the neck and withers measure quite 15 inches in length. The head is broad and large. The large boars are found solitary and also with the sounders, which do not appear to be generally composed of many individuals. Eight I think was the largest number I saw together. They have a habit of carrying their tails bolt upright at right angles to their bodies when on the move. I watched a sow and a well-grown young one that had not been disturbed for more than half a mile leisurely proceeding across some open ground, and they never once lowered their tails. The wart hog feeds and moves about at all times of the day. He could be ridden and speared in a great many places, though I believe he does not show much fight. I was told, though I did not see it myself, that they take to holes in the ground, backing in stern foremost. Whether they make these burrows themselves or not, I don't know. The Somalis being staunch Mahomedans look on the wart hog with disgust, and when you shoot one they won't touch it, so you have to cut off the head, carry it home, and do the cleaning of it yourself. The same prejudice prevents your having bacon for breakfast or trying what wart hog pork is like.

Hyæna crocuta

Is the commonest hyæna in Somali land. It is a much more powerful animal than the striped hyæna. It is yellow in colour, the skin thickly spotted with brown spots; the hair is quite short, and there is a slight ridge of hair on the neck and withers. The tail is not bushy like that of the striped hyæna. He is a great nuisance, as you cannot tie out for lions without sitting up over the animal yourself, the hyænas being pretty sure to kill and eat the gara. They are said to be cowardly, and no doubt would not dream of attacking a man, but they are bold enough to attack and kill sheep when out grazing in the daytime, and at night time will kill cattle or donkeys that are left out. I was told they will also take a mouthful out of a sleeping man. If you are sitting alongside a kill at night, the spotted hyæna appears at sunset, and sometimes before, and eats away within a couple of yards of you (of course you are concealed in a bush or behind a zereba of thorns) but after you have thrown stones at him and he knows you are there, he will return again. They make a great variety of noises, from a deep growl to a loud discordant howling, which it is impossible to describe. Should a lion come to the kill the hyænas retreat for a short distance, but if the lion, as he often does, stops in a neighbouring bush, the hyænas come up again, you then hear a tremendous scurry as the lion chases them off the kill. The hyænas don't appear to be afraid of a dead lion, as one night when I shot a lioness two hyænas came, one laid hold of it by the hind leg and the other by the root of the tail, and dragged it away 20 yards before I knew what they were doing, and would no doubt have eaten it, if I had not gone to the rescue. If your camp is not within a good zereba of thorns, these brutes will come through the hedge and carry off anything at all eatable. One night a hyæna carried off from close to my bedhead a leather water chagul, which I should think could not have been very nutritious. In the daytime also they are sometimes seen loafing about, especially if there is a kill. The animal has the drooping quarters and slouching gait of the hyæna. The anatomy of this hyæna is unique; it being impossible from external examination to tell the male from the female, a circumstance which led to the belief among the ancients that this animal was bisexual in its nature. This belief, according to Burton in his "First Footprints in Eastern Africa," still exists among the Somalis. He says: "The Somal declare the waraba to be a hermaphrodite, so the ancients supposed the hyæna to be of both sexes." I regret that my knowledge of the Somali language was too limited to enable me to find out for myself whether this is so. According to other authorities, this belief also exists in other parts of Africa. A very complete account of the anatomy of the spotted hyæna is given in papers published in the volumes of the P. Z. S. of London in the years 1877, 1878 and 1879, to which those interested in the subject may refer, and I may mention that in those papers quotations will be found on the same subject from Herodotus, Pliny and Ælian.

Hyæna striata.

This is the same as the Indian hyæna, though the one I shot was very much better clothed with hair than the hyænas one sees in the hot weather out here. The hair on the body of the female I killed, for half the length of the body behind the shoulder, was quite 9 inches long, and the rest of the animal was very hairy and it had a fine bushy tail, as will be seen from the photograph I now exhibit. The colour also seemed to be much clearer and brighter than that of the Indian hyæna. This hyæna is not nearly so common as the spotted hyæna. It does not attack the flocks, and is looked on by the Somal as harmless. One during the daytime laboriously dug a deep hole in the ground in its efforts to get at a carcase I had covered with thorn bushes.

Felis leo.

THE Lion is so well known that any detailed description of him is quite unnecessary; a very good account of his ways is given in Mr. Selous' book, " A Hunter's Wanderings in Africa." The lion in its wild state does not grow so luxuriant a mane as adorns the menagerie lion, but at the same time some of the old lions in Somali Land have very handsome manes. I think, without exception, all the old lions in that country have black manes, the yellow maned ones being younger lions; that is the opinion, at all events, of the Somalis.

I never saw a lion with a line of long hair running along the belly as one sees in a menagerie lion, and I see that Mr. Selous says he never saw a wild lion with that fringe of hair. On the other hand, in Harris's "Wild Sports of Africa" the lion is pictured and described as having that ornament. There is a tuft of long hair on the elbow of the Somali lion. Most naturalists are agreed that there is only one species of lion, though the varieties in the colour and length of mane lead some people to an opposite conclusion. The Somali lion has one peculiarity that I have not observed noticed, and that is that both lions and lionesses are spotted with pale brown spots along the lower part of sides and belly, and on the legs. These spots are most conspicuous if the animal is young, but they are well marked on the old lioness, and though much fainter are discernible on the old lion. A photograph brings them out with great distinctness. Now if you look at the lions in the Zoological Gardens there is no sign of these spots as far as I remember. I have a photograph here of a 9 ft. 1 in. lion with a fine mane which brings out the spots very clearly. The tips of the ears of some are black, in others there is a black bar across the middle of the ear, the tip being yellow. Sir Samuel Baker told me that the lion has a horn ¼ of an inch long at the end of the tail, but as I did not know it, I did not look for it or notice it. The black tuft at the end of the tail in old ones has numerous white hairs in it, making it an iron grey. This the Somalis told me was a sign of age.

Lions are much noisier than tigers; they seldom roar, but as they walk about at night keep up a constant singing kind of noise which is difficult to describe. It can be heard for a long distance. It is curious that they should do so, as one would think they would, when on the prowl, not warn animals of their approach. I have, however, heard them night after night for hours speaking as they went along. Some nights they don't talk at all, although their tracks show they are still about. Lion shooting is a very fascinating pursuit if conducted in the proper manner, which is to track the animal till you come up to where he is lying. Another mode not without its attractions, but not to be compared to the former, and one I only adopted in the hills where tracking is impossible, is to sit up at night over a kill. The first method yields the best of sport, as at the end of the track, which may last for several hours, your eyes suddenly fall on a lion sitting in the dense gloom of a bush within a few feet of you, when you can make sure of him, or, sometimes, the track leads into a thicket of thorns that you cannot penetrate into, when the best plan is to set fire to it and stand at the other end. I only once found one sitting in the open; it was a lioness with a well-grown cub. They were sitting on the open sand under a small thorn-tree. So well does their colour harmonize with their surroundings, that we tracked to within 4 yards of them without seeing them, and would not have seen them then if they had not got up. On another occasion my men pointed to a lioness we were tracking crouching in the grass a few yards off, but although I stared my eyes almost out of my head, I could not see her till she moved her ears. Tracking up to your game is much better fun than beating, and it has the advantage of rendering it almost certain, if you get on the tracks on suitable ground, early enough in the day, that you will get your shot, which ought at such close quarters to be equivalent to getting the animal. As far as I know, like every other animal, the lion tries to avoid you until wounded, and it is only in exceptional cases of there being young ones to guard, or from astonishment at seeing you so close to them, that they charge when you are tracking them. I was never charged by an unwounded one. To sit up for them at night I prefer sitting alongside a natural kill. As there are no trees you sit on the ground and render yourself secure by building a zereba of thorns so as to enclose a circle of about 8 feet in diameter in which you sit with a hole to fire through. It is a work of some time to do this, and if you do not get news of the kill in time to build a zereba, you can get a hole cut in a bush and put some thorns in front of you and sit there; the great thing is to sit almost touching the kill, as on dark nights, which are the best, you cannot see anything 4 or 5 yards off. As soon as it gets dark, hyænas and foxes begin to gather to the carcase, and if you have not tied it, the hyænas will drag it away. The hyænas and foxes will keep you amused for hours in watching them even if the lion does not return to the kill. I have also sat up over an animal tied out, but never got a kill in this way, though one night the tie out, a donkey, brayed lustily as I heard the heavy gallop of the lion rush up to it. Next moment all was silent, and looking through my peep-hole the donkey was standing unharmed. I shortly afterwards heard the lion growling close by, but he went away without touching the donkey again. Next morning I found the lion's foot-prints under the donkey's nose, but apparently the donkey had not been touched. Two days later I noticed a swelling between its forelegs, and found the lion had put its paw between its leg and given it a slight scratch. The lion had evidently tried to throw it over with its paw and had failed, probably because the donkey was tied by the leg to a stone buried in the ground, and the upward movement of the lion's paw would be in the line of resistance. Within a few minutes of the donkey being attacked, it was calmly eating, which showed its nerves were not affected. The donkey lived all right afterwards. Lions generally seize their prey by the throat, but by no means universally so. I examined the following kills:—three camels all seized by the throat; two goats by the back of the neck; one donkey by the lower part of neck at the junction of the body; one donkey seized with claws on the face and belly but not bitten (this animal survived); one cow by the throat; and the donkey with the above-mentioned claw-wound between the forelegs. Most of the above were natural kills, as one is unable to tie out much, owing to the hyænas. The way a lion kills a camel, according to the Somalis, is that he leaps on its quarters, the camel turns back his head to protest against this proceeding and thus brings his throat within reach of the lion's jaw, who takes advantage of the opportunity to close upon it, and certainly from the claw marks on the kills of the old camels that I saw, it appeared that such was the case. There were no marks on any of these kills of the lion having delivered any blow with the paw. One that got hold of me also did not strike with the paw. Sir Samuel Baker, however, gives a number of instances of their striking with the paw. I came across a curious instance of the limited intelligence of a lion. I found the carcase of a camel at which three lions had been eating, one at the rump, one at the stomach, and one at the forequarter and face. Now the one that had eaten the rump had buried the raw surface left after his meal by kicking up a heap of sand over it, so that it should be concealed from the vultures, but the other places where the others had been eating were left exposed, his instinct had not told him it was useless to cover up one place without covering up the others. I know these were three lions, as I had been tracking them off and on and losing their tracks in the hills for a fortnight. I got two of them over this camel. Once when tracking them I saw all three in the early morning pass the sky-line of the ridge of hills 300 yards above me, but I lost the tracks. I think lions generally kill in the daytime, the reason being that the flocks and herds are all secured within a zereba at night. All the natural kills I heard of were in the day-time. Ties up, when killed, were of course killed in the night. They will eat any dead animal whether killed by themselves or not. Lions sometimes leap over the high thorn hedges within which the Somalis have their encampments and kill an animal, or several, inside: in such cases they eat where they kill, and cannot leap out again with their prey. There are a number of man-eaters. I shot one that a short time before had leapt into a zereba and killed and eaten a man inside. I saw the man's garment bloody and full of holes on the hedge of the zereba when I got there. The Somalis told me they frequently take men out of a zereba at night. I found the remains of a porcupine inside a lioness I shot that she had eaten the night before. She had swallowed the feet whole and also a lot of the quills. The habit of swallowing the feet whole is a common one with the *Felidæ*. Lions drink pretty regularly in the hills where there is water, but they are able to go for months without drinking water. This is incredible to those who know how necessary water is for the existence of tigers and panthers; but, that it is so, I have no doubt. I have shot them 30 miles from any water; and tracts of country which they inhabit are waterless for many months of the year. They charge with the same coughing roar that a tiger does, and come at great speed close to the ground, not bounding in the air as you see in pictures; their ears are pressed close to the head, giving them the comical appearance of being without ears. So large an animal coming at full speed against you of course knocks you off your legs. The claws and teeth entering the flesh do not hurt so much as you would think. The only really painful part of the business is the squeeze given by the jaws on the bone. I felt none of the dreamy stupor Livingstone describes, but, on the contrary, felt as usual. I adopted the course of lying quite still, which, I believe, is the best thing one can do, as you are quite helpless with a heavy animal on you, and they are inclined to make grabs at everything that moves, and the fewer bites you can get off with the better. All the wounds are centres of inflammation and blood-poisoning, and the more you get the less chance you have. The power of the lion's jaw may be inferred from the fact that the lioness that seized me, although it had a broken jaw, scored deep grooves in the barrels of my rifle with her teeth. Some claw wounds were mere scratches, which I attribute to the fact that they clutch at the surface of your coat thinking it is all solid underneath, and so reach the flesh pretty late. In fact, my coat was torn in some places without any corresponding wound beneath. I never felt the slightest shock. Tigers and panthers as a rule immediately leave any one they seize in a charge, but this lioness, having left me, went a few yards to roar at my men, returned and stood on me growling, and then bit my arm: I got no bite the first go off as she was occupied in biting the rifle.

Comparing the size of lions with tigers I should have been inclined to say that tigers were the heavier of the two. But Sir Samuel Baker in "Wild Beasts and their Ways" expresses a contrary opinion. Mr. Selous in his book gives the weight of one large lion in poor condition as 376 lbs. Jerdon gives the weight of an Asiatic lion 8 ft. 9½ inches long as 35 stone. Mr. Selous says that the largest male he shot was nearly 10 ft. long, while of 9 lionesses the pegged out skins measured from 8 ft. 10 in. to 9 ft. 7 in., which would make the animal in the flesh at least a foot less in length. The largest lion I shot measured as he lay 9 ft. 1 in. The largest lioness was 8 ft. 3 in. Another old lion I got with a very fine long mane measured 8 ft. 8 in. Coming to the measurements of the skulls (and I hold a strong opinion that the size of the skull of tiger or lion gives a better idea of the bulk and weight of the particular tiger or lion than the measurement of its length), I have measured some skulls I have of tiger and lion of the same or about the same length, and the result is as follows:—

Lion (No. 1). In length 9 ft. 1. Skull length about 14½ or 15 inches, width 10½ inches, depth 6½ inches.

Lion (No. 2). In length 8 ft. 8. Skull length 12¾ inches, width 9 inches, depth 6 inches.

Tiger (No. 1). In length 9 ft. 5. Skull length 14 inches, width 10 inches, depth 6½ inches.

Tiger (No. 2). In length 9 ft. 1. Skull length 12¾ inches, width 9½ inches, depth 6½ inches.

Tiger (No. 3). In length 9 ft. Skull length 12¾ inches, width 9½ inches, depth 6 inches.

I have given the length of skull of Lion No. 1 as about 14½ or 15 inches, as a portion of the back of the skull has been shot away; the actual length of what remains is 13½ inches, but as the whole of the occipital protuberance has gone, I estimate it at least 1 inch and probably 1½ inch longer.

It will be seen that Lion No. 1 and Tiger No. 2 were exactly the same length of carcase, but the skull of the lion is the bigger. The skull of the lion is much flatter on the top than that of the tiger, and you can easily recognize the one from the other.

The skull of the lioness is much smaller than that of the lion. Her measurements compare with those of a tigress as follows:—

Lioness. In length 8 ft. 3. Skull length 11 inches, width 7½ inches, depth 5 inches.

Tigress (No. 1). In length 8 ft. 1. Skull length 11½ inches, width 7¾ inches, depth 5¾ inches.

Tigress (No. 2). In length 8 ft. 2. Skull length 11¾ inches, width 7¾ inches, depth 5¾ inches.

Tigress (No. 3). In length 8 ft. 4. Skull length 11½ inches, width 7½ inches, depth 5¾ inches.

The width of the skull of another old lioness 8 ft. 2 long, is 8 inches, but the whole of the back of the skull being shot away prevents my giving the length.

The lioness's head is apparently smaller than that of a tigress about the same length.

Shooting with an 8-bore solid lead bullet with 9 drams of powder I hit an old lion in the centre of the forehead; the ball carried away the back part of the skull and lodged between the shoulders. A similar ball sent through a lioness's head lodged in the foreleg. The ball in each case was quite flattened out, but the want of penetration with so large a charge of powder astonished me. I generally shot with a ·500 Express by Henry, and only lost one animal that was hit, and that was a gazelle.

Of the other animals the panther appeared to be the same as the Indian panther. I often saw their tracks, and occasionally at night heard their harsh grating roar. I only saw one, and that got up and stood close to me when I was shooting partridges, but by the time I got my rifle he was off and I missed him. A skin I saw with some

Somalis was a very large pale-coloured one. The Somali elephant has, I believe, as a rule, small tusks, though occasionally a good one is procured. I was not in the part of the country they were in. Of smaller animals there is a hare about the size and colour of the Indian one but with longer ears. Porcupine are common, but being nocturnal in their habits you do not see them, and the only one I saw was inside a lioness. Two kinds of foxes: the most common and largest has a black back (Somali "Daman"), and a smaller kind of a uniform brown colour: and in one place I saw a large colony of dog-faced baboon, about 200 in number: the males have long manes; the young ride on the backs of their mothers, and not, as in the case of the Hanuman monkey, clutching on to the chest.

LANDSCAPE GARDENING IN NATIVE STATES.

BY H. ST. JOHN JACKSON.

In No. 1, Vol. VI., of the Society's *Journal*, Mr. G. Carstensen, Superintendent of the Victoria Gardens, Bombay, has given a most interesting account of the progress of landscape gardening at the capitals of certain Native States in the Western Presidency, *viz.*, Baroda, Bhownaggar and Rajkot. It has occurred to me that a description of the gardens in some other Native States, which perhaps Mr. Carstensen has not seen, and with which I am personally acquainted, may prove of interest to the readers of the *Journal.*

Before proceeding to describe them, it may not be out of place to make a few observations on the subject of gardening in India. Any one who takes an intelligent interest in this idyllic subject cannot have failed to observe the extraordinary apathy evinced by the rich and intelligent natives of the soil in this most fascinating of pursuits. To the average native the *gainda* (Marygold), *Toolsee* (*Ocimum sanctum*), and a few other well known indigenous plants, represent the sum of horticultural science. So long as they can get a few leaves of the *Toolsee* for their *poojah*, and a few flowers of the *gainda* for decorative purposes, they are not troubled about anything of more æsthetic or economic value. The *Maulsari* (*Mimusops elengi*), the *Chumpa* (*Michelia champaca*), a few varieties of Jasminums, and the

Harsinghar (*Nyctanthes arbor tristes*), afford them an abundant supply of powerfully scented flowers for the purpose of decorating their persons by means of garlands, and that is about all they care about. To find natives of India who possess any idea of landscape gardening is very rare; indeed, I do not remember to have met with a single such specimen during all my experience. It is therefore not to be wondered at that the homes of the people of this country do not present those features which we are accustomed to look for among the residences of the rich and intelligent. During the reign of the Mahomedan kings magnificent monuments of architectural beauty were raised, which stand to this day as silent evidences of their love of luxurious living; but we look in vain for any attempt at landscape gardening. Even the Taj, that "dream in marble," had but a poor garden around it. The grounds were simply divided into squares, with a row of fountains going up the centre. That certain places lend themselves naturally to the development of high class gardening, will be readily admitted by any one who has visited some of the capitals of the ruling chiefs in Rajputana, notably Jeypore and Oodeypore; in both these places are to be found perhaps two of the finest laid-out gardens to be met with anywhere in India. I will first of all describe that at Jeypore.

Here, the spot where now thousands of the Maharaja's subjects spend their evenings in dreamy enjoyment, was once a dreary waste; a perfect eyesore, where the sewage of the town was deposited. It was covered with prickly pear jungle, and was a sandy waste, in which nothing, it was said, would grow. The spot lies between the two principal gates of the city—the Ajmere and Sanganeer gates, and running parallel with the walls of the city. In 1869 Rajputana was devastated by one of the worst famines on record, and the late Maharaja, Sewai Ram Singh, hit upon the happy idea of converting this eyesore into a garden, which was then started as a famine relief work, where thousands of the starving population were provided with work and wages. Dr. F. W. A. DeFabeck, at present Surgeon-General, Madras, was at that time Residency Surgeon at Jeypore, and it was he who originally designed the now famous "Ram Newas" public garden, which has served as a model for several other gardens in various parts of India. But the first design had to be considerably modified to suit local surroundings and circumstances, the most important of which was the water-supply, which was entirely dependent upon wells, and these were always running dry during the summer months.

In the "Ram Newas" are to be found various styles of landscape gardening, the Italian being the most picturesque. The natural, the gardenesque, the geometrical, and the terraced, all finding an appropriate place. The clumping of shrubs *en masse* with striking effect forms one of the most beautiful features of the garden. The lawns, of which there are no less than four of considerable size, (one of them a cricket lawn 100 yards square,) with grass borders and beds, are perhaps the chief features of the gardens. Full advantage has been taken of every "vista point," all of them being most skilfully taken in. The north side of the garden, running parallel with the city wall, and between the two gates above mentioned, is fenced in by an ornamental cast-iron railing, which was got out from England at considerable expense; the other three sides having a fencing of galvanized wire netting, the whole being studded on a stone wall 2½ feet high.

The visitor enters the garden from the Ajmere gate side, through a pair of handsome cast-iron gates, with a fine sweep, the gate pillars being surmounted by handsome gas lamps. He may here either get out of his conveyance or drive round east or west. Before him is a handsomely carved stone balustrade, each pillar having an ornamental flower pot of Etruscan or terra-cotta ware. In the distance, due south, the ancient fortress of *Motee Doongree* (pearl mound) meets his eye, and in the foreground is what used to be the European Head Gardener's house, now a sort of drawing-school and store-house. The visitor then descends an ornamental flight of stone steps, and finds himself immediately in the midst of a beautifully laid out flower plot, the beds being of geometrical pattern, filled with roses and ornamental shrubs. Immediately in front are two lovely lawns, laid down with "Doob" grass (*Cynodon dactylon*), and bordered on every side by geometrically-cut beds with a background of shrubs planted *en masse*. Were the visitor to turn to the left, he would pass through fine clumps of shrubs, by winding paths bordered with "Doob" grass, through the lovely "Bower of sweet odours," passing a grand fountain in red sandstone, on to a circular-stepped rose garden. This is nothing less than a huge circle enclosed by a carved stone wall, with steps on the outer side for potted plants. The interior is beautifully laid out in geometrical beds filled with choice rose plants, and in the centre is a fountain, the basin of which is filled with water-weeds of sorts, in which ornamental fish disport themselves, while overhead is an ornamental bower, covered with climbing plants. On emerging from this, the visitor finds himself amidst the terraced garden, from which he proceeds to what is known as the "Ornamental tank." Anything more beautiful than this tank it would be difficult to find. It is designed with consummate taste, having a beautifully carved railing of red sandstone with marble top and red sandstone fretwork, which the stonemasons of Jeypore turn out so well. Still proceeding east, the visitor finds himself in the Rosarium, which was laid out by me in 1875. Originally this plot was occupied by a maze, which it was found difficult to maintain owing to the great prevalence of field rats, which used to take a particular delight in destroying the roots of the *Mehndi* hedge, as well as afterwards of the *Inga dulcis*, by which the *Mehndi* was replaced. From the Rosarium the visitor, still going east, comes out on to a kunkur carriage drive, and turning south, finds himself facing the splendid bandstand, where the Maharaja's fine band plays once a week; and beyond that the magnificent Albert Hall, the foundation stone of which was laid by the Prince of Wales in February, 1876. The bandstand is in itself a promenade, lighted with gas, and having a wide drive all round, which again is surrounded by as fine a specimen of geometrical gardening as can be seen anywhere. Standing on the bandstand, and looking due north, the visitor sees in the distance the picturesque fortress of Nahargarh perched on the summit of a range of hills, in the midst of which the modern city of Jeypore nestles. Turning to the west, the fortress of Hathrohi, rising abruptly out of a sandhill, meets the eye; while on the north-east, first the dome of the Mayo Hospital, which is immediately outside the garden, and in the distance the sacred shrine of Gulta, perched on the summit of the eastern ridge of the hills, present themselves to view. Looking to the south from the same 'coign of vantage,' the visitor sees the Albert Hall, a magnificent edifice in the Saracenic style of architecture, erected by the late Maharaja in memory of the visit of the heir to England's throne to Jeypore. This building serves the purposes of a museum, library, and town hall. Here may be seen collected some very rare and choice *objets d'art* from all parts of the country, but especially the artware for which Jeypore and some neighbouring towns are famous.

Descending from the bandstand, and wending his steps south-west, the visitor finds himself facing the beautiful Aviary,also designed by Dr. De Fabeck. It is one of the finest of its kind in India, the style of architecture being Saracenic, in conformation with the surrounding buildings. Here may be seen birds of rare and beautiful plumage, collected from all parts of the world. Attached to the Aviary is an idyllic Tealery, in which aquatic birds of sorts find a congenial home. Turning due west, the visitor comes suddenly upon the extensive Vinery, which is made up of white marble pillars and covered with vines procured from such distant places as Egypt, Portugal, France, Afghanistan, and some of the delicious varieties of grapes grown in the Nizam's dominions, notably the famous "Habshee," or black African variety. There is also a romantic looking serpentine lake, which in my time used to be called the "Infernal regions," from the thick undergrowth of trees studding its sides, before getting to the fairy-like parterre at the bottom, or centre of the lake. Here deer and other wild animals of a harmless type were allowed to roam at pleasure. There is also an extensive deer park, and a fine collection of the carnivora of Rajputana. A vegetable garden of considerable extent supplies the needs of the European population in the way of European vegetables. There used to be a separate fruit garden in my time, but this has now given place to grass plots and the ornamental grounds surrounding the Albert Hall. Facing the east gate, leading into the Mayo Hospital, stands a colossal bronze statue of the late Lord Mayo, who was a close friend of the late Maharaja. The design of the Mayo Hospital is also from the facile pencil of Dr. De Fabeck. The whole garden is lighted with gas; while carriage drives twenty feet wide intersect the garden throughout. And here I will take leave of the "Ram Newas" Garden.

I note here with regret that this splendid garden, onwhich some lakhs of rupees were spent is, and has been, ever since I left it, without a trained European gardener to direct its operations; and I feel sure that, unless this want is supplied, there is every prospect of the garden degenerating into a mere place of recreation in a few years, instead of being maintained as a repository of all that is beautiful and useful in the vegetable kingdom, which it was intended to be by the late Maharaja Ram Singh.

The next garden that appears to me to deserve attention is the "Phool Bagh" at Gwalior. It is some years since I was there, but I remember it as possessing several natural advantages which only required the hand of the landscape gardener to be turned to account to render them beautiful adjuncts to a garden. Scindia's new Palace stands in the midst of this garden, the design of which had not then been definitely decided upon. There were several rustic and ornamental bridges spanning a stream which had been skilfully brought in, and flowed through the garden, and which at some places was utilised as a waterfall. There was at that time an attempt at landscape gardening in the most elementary meaning of the term. But since then the services of one of the ablest gardeners in India (Mr. Charles Maries, F.L.S., late of Durbhunga) have been secured, and I learn that he has succeeded in transforming the Phool Bagh into a veritable paradise; plant houses, ferneries, orchid houses, *et hoc genus omne*, have sprung up as if by magic; parterres and flower plots, lawns and shrubberies, with winding paths, are now prominent features. Of course, I have not seen these myself; but a friend of mine, who was there recently, tells me that all the possibilities which I had seen several years ago in the Phool Bagh have been more than realized under the able direction of Mr. Maries. The Maharaja Scindhia has a first class specialist in Mr. Maries, and should make the most of him.

Readers of the *Pall Mall Budget* have been made familiar with the romantic and beautiful surroundings of the capital of Meywar—Oodeypore, from the sketches and letter-press descriptions sent to that journal by Mr. W. S. Caine, late member for Barrow. The "genial ruffian" has an eye for the beautiful and a facile pen. The Maharana's Palace stands in the midst of a lake, and is surrounded by a beautiful garden, where the landscape gardener's art can be seen to great advantage. Mr. Storcy is the presiding genius of this sylvan retreat, and well has he turned to account every natural advantage. The flora of Rajputana is not very rich in ornamental trees or shrubs, that is, of indigenous species ; so that everything in the shape of ornamental shrubs has been imported ; and being placed in conditions most suited to their wants, have developed into their best forms. The globe trotter cannot do better than pay a visit to Oodeypore if he wishes to see something really unique in the way of landscape gardening.

Among the native princes of Bengal one of the most enlightened is the Maharaja of Durbhunga, whose rule has been marked by the construction of some really useful works of public utility. Among the most beautiful of these is the splendid garden, laid out and stocked by Mr. Charles Maries, now at Gwalior. This gentleman was for several years at Durbhunga, where he has left abundant evidences of his skill as a landscape gardener. One of the finest plant houses I have ever seen is that put up by Mr. Maries at Durbhunga ; while in the matter of stocking it with rare and choice plants, it will bear favourable comparison with the splendid structure in the Royal Botanical Gardens at Seebpore, near Calcutta—the work of Mr. Parsons, now in charge of the Anandale Gardens at Simla. The style of gardening affected by Mr. Maries at Durbhunga is the natural, or what may more properly be termed the "gardenesque," style. The clumping together of shrubs, according to their habit of growth and size, forms a special feature of this garden ; and this is the style which, in my humble opinion, is the most suited to Indian gardens. We out here possess a very large and varied collection of ornamental shrubs, well adapted for massing ; and grown in this way their effect is very striking. A judicious sprinkling of geometrically laid out beds cut out in *Doob* grass ; with borders divided off into ovals and circles formed with *Doob* grass, seems to me to be all that is necessary in this line in a garden of moderate extent ; and this happy medium has been well observed at Durbhunga. I am not aware if a successor has been found for Mr. Maries at this place, as I was there a few years back, when he had just left.

It is out of the province of this paper to deal with gardens not situated in Native States; but I take this opportunity to state that, from the landscape gardener's point of view, the finest specimen of his art, in my opinion, is the Eden Garden at Calcutta. Anything more perfect in harmony of outline and grouping together of plants; the undulations of surface; the promontories and grottos; the gracefully winding paths and the equally winding course of the serpentine, all form in themselves a perfect whole such as I have not seen anywhere else in India. The only deficiency of this lovely garden consists in the absence of carriage drives; but these were, I understand, advisedly omitted owing to the limited space within which a perfect galaxy of beauty had to be crammed in. There can be no doubt that the man who designed this garden must have been a past master in the art of landscape gardening. It would be well if some of our large Native States, possessing spare ground, would take the Eden Garden as a model, and have it laid out accordingly.

MISCELLANEOUS NOTES.

No. I.—NOTE ON

CASSIA GRANDIS, LINN., AND *C. MARGINATA*, ROXB.

Attention may be invited to those two species of Cassia because they are not met with in our gardens as often as their merits as ornamental trees deserve, and because they are apt to be taken as of one species. Both are included in the Section Fistula, of DeCandolle, named apparently from the pipe-like pods so well shown in Cassia fistula, Linn., the Bawa, or Umaltas of this country.

Cassia grandis, Linn., is stated by DeCandolle to be a native of the Islands of the Caribbean Sea, of Guiana, and Brazil. In Western India there are very few mature specimens. To one, in the garden of Lady Sassoon at Poona, the attention of the writer of this paper was drawn by Mr. Solomon, a student of the College of Science, Poona, and there is also one in the old Botanic Garden at Hewra. The specimen at Poona is a handsome tree about 25 feet in height, of open habit, with ascending branches, bearing alternate, stipulate, distichous leaves, of from 10-20 pair of stalked leaflets, which are oblong mucronate with entire, thickened and reflexed margins, and attaining about $1\frac{1}{2}'' \times \frac{3}{4}''$ the largest leaflets being slightly below the centre. In colour the young leaves are of a ruby tint, softened by silvery pubescence, but ultimately become smooth and green. The petiolules are about $\frac{1}{6}$ inch in length and the stipules wedge-shaped $\frac{1}{8}$ inch in length.

The flowers are produced during March-April, in numerous short racemes which combined form a grand paniculate inflorescence. Both calyx and corolla are rose coloured, softened by silvery pubescence, and ultimately change to salmon colour; they may be seen in company with the ripening fruit of the previous year, which consists of subcylindrical woody pods 1 foot in length by 1 inch in thickness, having two thickened sutures and transverse striæ and containing a pulp between the seeds with an odour similar to that of Bawa.

Cassia marginata, Roxb., is much better known in this country; it is a native of Ceylon: a specimen in the Bund Garden at Poona has long attracted great attention by its graceful foliage, which is very similar to that of the last mentioned tree, and its very numerous flowers, in colour, pink, marked with greenish veins, produced during July-August. As it is fully described in Roxburgh's Flora Indica, it is only necessary to note a few of the points of distinction between this species and C. grandis, Linn.

Cassia grandis	C. marginata.
Flowering Season March-April.........	July-August.
Stipules cuneate ⅛ inch..................	Semi-saggitate with curved points, that is, resembling the Italic letter *f*.

Both species thrive at Poona with occasional irrigation. Cassia marginata blooms from its third year, if well grown, and is naturally of very graceful habit. Its erect stem clothed to the ground with slender ascending branches may well be left untouched by the pruning knife.

G. MARSHALL WOODROW.

Poona, December, 1891.

No. II.—BRANCHING PALMS AND TREE-FERNS.

In Vol. III. of this Journal, p. 250, Mr. W. E. Hart gives a "Note on some Branching Palms," and illustrates two of these, both Date Palms. In Vol. IV. of the same Journal Mr. W. F. Sinclair, Bo. C.S., gives a note on a many branched Areca-Nut Palm. Lastly, in Vol. V. of the *Journal* the present writer refers to certain branching Tree-Ferns seen or heard of by him in Sikkim. The subject is such an interesting one, that it may be of advantage to draw attention to two papers on the subject that I have lately happened to light upon. The first is "On Branched Palms in Southern India," by S. Pulney Andy, M. D., F. L. S., &c., Travancore, in The Transactions of the Linnean Society of London, Vol. XXVI., p. 661 (1867). A plate (LI) is given, and illustrates a branched Palmyra Palm (*Borassus flabelliformis*) "possessing entire branches and four abortive—two on either side;" another Palmyra representing a ramification "principally into two, but in one instance into three branches;" lastly, a Cocoa-nut Palm (*Cocos nucifera*), representing a dichotomous division. The second paper is entitled "Notes on the Tree Ferns of British Sikkim, &c.," by John Scott, Curator of the Royal Botanical Gardens, Calcutta, l.c., Vol. XXX., p. 1 (1870). At page 16 Mr. Scott gives much interesting information regarding the ramification of the stems.

LIONEL DE NICÉVILLE, F.E.S., C.M.Z.S., &c.

Calcutta, November, 1891.

No. III.—THE PROTECTION OF GAME IN SIND.

I beg to enclose copy of a circular recently issued by Mr. James, Commissioner in Sind, because I feel sure that you and other members of the Society will be glad to hear that the difficulty of protecting birds from wholesale destruction during the breeding season has been surmounted in Sind.

In this Province the right over "fur and feather" has always been reckoned a strict Government monopoly, and has descended to the British Government from the late Amirs. It is to this day exercised by selling the privilege of catching wild fowl on the different lakes, such as the Manchar, for instance.

About half a century ago the old Amirs fell foul of the British Government on account of the strictness of their game laws and their refusal to permit wood being taken from their "Shikargalis" or preserves, and even now H. H. Mir Alli Murad Khan Talpur, G.C.I.E., who is the last of the reigning Amirs, enforces very strict game laws. It seems a very great pity that former rulers throughout India were not equally conservative of their sporting rights, and it is a question whether Government might not now generally assert them by law.

W. S. HEXTON.

Hyderabad, Sind. 23rd October, 1891.

CIRCULAR NO. 1525 OF 1891.

GENERAL DEPARTMENT.

Commissioner's Office,
Karachi, 23rd September, 1891.

MEMORANDUM.

The Commissioner is informed that persons have been in the habit of snaring and destroying, for the purpose of selling their plumage, the Black Francoline Partridge, the Blue Kingfisher *(Halcyon smyrnensis)*, and several species of Egrets and other birds, and to so great an extent that several species, useful for food as wlel as ornamental, have been rendered nearly extinct in some parts of the Province. Two persons have recently applied to the Deputy Commissioner, Thar and Parkar, for permission to destroy ornamental birds for the sake of their feathers, on the Eastern Nara, on the ground that they have cleared the species out of the Delta of the Indus.

2. The Commissioner desires, therefore, to remind District Officers that the right to destroy *feræ naturæ* as well as fish, has, in Sind, always been a Government royalty, and the privilege is sold in certain localities. No one, therefore, can be allowed the privilege *gratis* as against Government, and the Deputy Commissioner, Thar and Parkar, has, therefore, properly refused to grant the permission sought for.

3. Revenue and Police Officers are now directed to inform persons who have not paid for the right that they will not be permitted to destroy birds for the sake of their plumage, and to prevent their doing so.

4. District Officers are requested to report whether there are any fresh places where they would recommend the privilege of capturing birds being sold annually, as on the Manchar Lake. The Commissioner does not mean to interfere with European or Native sportsmen who carry guns under the Arms Act, or who kill game with falcons. His object is to maintain the rights of Government, and bring the capture of game under due control, as well as to protect various valuable and interesting species from wholesale destruction. Birds wear their handsomest plumage in the breeding season, when they are specially sought for by feather-hunters. It is, therefore, very necessary that they should receive adequate protection at that time, as the destruction of the parent birds means the death by starvation of the nestlings, and the rapid diminution of the species. The black partridge is now extinct in many parts of Europe where it once was common, and the Commissioner is informed that in some well-known localities in Sind it has become very scarce. This species needs therefore special protection from bird-snarers.

5. District Officers should remember also that game-snarers in India very often belong to thieving and wandering tribes, who commit petty depredations and burglaries under pretence of wandering in search of birds. Foreigners and persons found away from their homes with the ostensible purpose of snaring game should, therefore, be watched by the Police, and if unable to give any other account of themselves, should be warned to leave the district or called upon to give security. But care should be taken not to molest Mohanos, and other well known tribes of Sind, who catch birds for food.

H. E. M. JAMES,
Acting Commissioner in Sind.

No. IV. GEOGRAPHICAL DISTRIBUTION OF THE PIN-TAIL SNIPE.

Can any one say whether it is a fact, and if so what is the cause, that the farther South in India one goes the greater number of *Pin-tail* Snipe does one meet with, as compared with *Fan-tails*?

Some years ago when shooting with Mr. Doig on the Null in Guzerat I examined a bag of 30 couple, and found only 2 *Pin-tail* Snipes. Last month in Guzerat I examined 31½ couple and found no *Pin-tails*. The year before last I shot 16 Snipes at Budlapur near Kalian (Bombay) and 8 of them were *Pin-tails*. Yesterday near Madras I shot 17 Snipes, and there was not a single *Fan-tail* among them.

At one time I used to think these variations were due to the ground on which the birds were found, but I now doubt if that is the case. Possibly the *Pin-tail* Snipe leaves its Summer quarters and starts South before the *Fan-tail* and goes farther. *Quien sabe?*

W. St. JOHN RICHARDSON,
Captain.

Madras, 14th December, 1891.

No. V.—PROTECTION OF LARVÆ.

I met with a very remarkable thing a few days ago, which I have never seen before; and I send you a short account of it for the favour of publication in the Journal, in the hope that it may attract the attention of some member who may be able to throw light on it. Walking along a disused road through forest country, I noticed a large tree, of which the whole trunk and every branch, up to its extreme point, was wrapped in a tissue of pure white silk. I first thought this might be the work of spiders, but on closer inspection I found abundant evidence that the tree had been devastated by a host of minute larvæ. Their droppings lay thick on the leaves of the bushes below, like black powder, and in the silk itself I found a great many of their cast skins. I have examined these with a lens, and have no doubt they were the larvæ of a moth. They had destroyed every leaf on the tree, eating the soft substance only and leaving the skeleton. This must have happened some time ago, probably during the rains, and in many places the silk had been torn, or blown away, but in other places a yard of it might, with a little care, have been removed in a single piece. I brought away a small piece, which I send you for inspection. In appearance it is exactly like fine tissue paper, quite strong enough to be folded and unfolded without injury; but on examination you will find that it consists of two sheets, between which the larvæ probably moved, judging by the situation of most of the skins. To carry out such a stupendous piece of work, there must have been not thousands, but millions of larvæ, and it is difficult to imagine how they could work together to produce a tissue so perfectly uniform. The trunk of the tree was about three feet in circumference. The bark did not appear to have been eaten. About the foot of the tree there were great loose cobwebs of the same silk, embracing parts of the nearest grass and bushes.

E. H. AITKEN.

Ankola, North Canara, 7th December, 1891.

No. VI.—A NEW METHOD OF PRESERVING AND MOUNTING ZOOLOGICAL SPECIMENS.

The following is an extract from an interesting paper read by Mr. Haly of the Columbo Museum before the Ceylon Branch of the Royal Asiatic Society on 30th September, 1891 :—

"This paper ought, perhaps, to be confined to reading a simple recipe, which would only occupy your attention a minute or two; but in these days in which the development of everything is so carefully studied from fans and lawn-tennis bats to the nebulæ, I have thought that, perhaps, a short history of how the results exhibited in this room to-night have been arrived at, might not be entirely devoid of interest, although of an excessively technical character. The plot of my story may be summed up in carbolic acid: Carbolic acid as a failure and carbolic acid as a success. On taking charge of the Museum in 1875 I had not the slightest doubt about the success of carbolic acid, and expected at once to be able to have a good show, easily and inexpensively prepared, of all our reptiles and fish. My collection of English fish in London had been kept in a covered zinc pail, in a solution of 1 in 400, and although the fish of northern seas have, as a rule, so little colour that I had not gained much knowledge on that point, there was no doubt about the preservation of the animals themselves. I was very soon undeceived. A few experiments on the common fish and lizards of the Cinnamon Gardens showed that solutions of carbolic acid in water do not fit in Colombo as preservatives at all, whatever the strength employed. Such an experience ought to have warned me not to cry before I was out of the wood; but in 1878 I reported a great success to Government by first employing alcohol for a short time, and then removing the specimens to a solution of carbolic acid and nitrate of potassium. I may as well mention at this point that any form of the substances known commonly as salts, whether as poisonous as corrosive sublimate, or as harmless as alum, are all alike destructive in this climate to any specimens prepared by them. One of the most extraordinary instances of this was in a very fine skate most beautifully mounted for the Museum by the American taxidermist, Mr. Hornaday. The skin had been brought in brine from Jaffna, and soon after it was exhibited the fish began to give trouble. It was carbolicised, it was varnished, it was dried in the sun, it was painted; but it slowly dissolved before our eyes, exactly as the Cheshire cat did before Alice's, till nothing was left but its grin, represented by the curious dental plates on my office table: but even these broke up at last. I need scarcely say that whenever I saw any solutions described as being used by other naturalists I tried them also—they were all alike absolute and complete failures. The only approach to success was made by first preparing the specimens by arsenic paste, and then mounting in kerosine oil. This was, as we shall presently see, what is called "burning" in the game of hide and seek. A row of fish prepared in this way was exhibited, and preserved their form and colours beautifully for about six months, until one morning I found them nearly all broken up, and nothing left but a precipitate of muscle and bone at the bottom of the bottles. I came unwillingly to the conclusion that there was no means known, or likely to be discovered, that would preserve animals with a natural look about them, and that I should have to content myself with ordinary Museum spirit specimens. There was one branch of the animal kingdom, however, I had always been very anxious to make a good show of, and that was spiders. I naturally looked to microscopical preparations to solve that question, and amongst them tried an old and long abandoned one—gum and glycerine. This had been given up because of the great difficulties experienced with the air bubbles which formed so abundantly in it; but that did not matter to me. There was something about this mixture that strongly attracted my attention. Its action was unlike anything I had seen before, and I tried our beautiful little gold and red spotted fish in it, so abundant in the Colombo lake, and which are always my first test for the colour—keeping properties of my preservative. I found these little fish became semi-transparent and as hard as glass, and that their colours seemed as if they were burnt in. My health having broken down I was obliged to leave for England for a year, but I left behind me two rows of fish prepared in this way, one mounted in kerosine, the other in glycerine, with strict orders that they should not be touched till my return. I found twelve months afterwards that the row *in kerosine had broken up*; *but those in glycerine were as perfect as the day I left*. Specimen A, is one of them, mounted in October, 1884. It is exactly the same as the day it was put up. The first trouble was the enormous expense of the process. However I overcome this to a certain extent by filling up the bottles with lead vessels painted white. You will see that all the fish bottles are furnished with a lead or tin vessel. This saved glycerine; but it was the gum that was so costly, on account of the troubles in the Soudan. To economize as much as possible, the fish were first dehydrated in spirit, so that the gum and glycerine could be used over and over again. B is another specimen of a very beautifully coloured wrasse. The spots ought to be emerald green, and the bands on the head violet. I have no doubt they would be, but I see by the label that it was not placed at once in pure glycerine, but seems to have been experimented with, how I do not recollect. I suppose, seeing the colour fading, it was changed to pure glycerine, but too late to save the more delicate tints. C is a star fish prepared by the same process some years ago. But here the usefulness of this process ends. Only very scaly fish, such as sea perches, and wrasses, and a few edimoderms can be prepared in this way. Ordinary fish, snakes and frogs are withered up by it out of all recognition, and rendered as hard as iron, Was there any possibility of rendering the specific gravity of the gum and glycerine less? This was a question to which I devoted myself for a long time. No additions of watery solutions of any substances were of any avail. At last I found that by gently mixing with weak spirit, briskly stirring all the time, that the gum, at first precipitated in flocculent mases, was redissolved, and that in that way solutions of almost any specific gravity could be obtained. D is an extremely rare frog, presented by Mr. Green, prepared and mounted in 1887 in gum and glycerine reduced by spirit to the same specific gravity as milk. But it is only very small specimens that could be mounted in this way, the medium being too opaque for any larger bottles, nor is it a good mounting medium even for them. The specimen exhibited is in a very soft state. I could not allow it to be handled, and hence it is useless for scientific examination. The delicate violet tint of the large blotches on the back, is, however, well preserved. If we attempt to mount specimens preserved in this way in pure glycerine, they are shrivelled up quite as, or almost as, badly as if preserved with the full strength of the gum and glycerine mixture. Many attempts were made to reduce the specific gravity of the glycerine. It may be asked why not have tried spirit? The answer is that one of my very first experiments in this Colony were mixtures of glycerine and spirit. They are most powerful preservatives, and have the inestimable advantage in this hot climate of not evaporating or at least not perceptibly, but they are absolutely destructive to all colour, bleaching the specimens with great rapidity. If watery solutions of salts or acids were used to reduce the specific gravity a grand crop of fungus sprung up at once. The only successful chemical was chloral, but it was soon found that light colours faded in watery solutions, almost as soon as in alcoholic preparations. E is an example of a chloralized glycerine solution of about the specific gravity of milk, three years old; but it is expensive, and has no particular advantage, except that it does not evaporate. My next experiments were solutions of gelatine in spirit. It is a very good preservative; but it does not keep colour. There is, perhaps, nothing better for frogs, all the delicate folds and glandular lines so important in identifying the species of this very difficult class of animals being preserved as in life. The mixture is made by soaking a packet of Nelson's gelatine in a pint of cold water for 10 or 20 minutes, which is sufficient in this climate. After dissolving it by a gentle heat, it is carefully stirred up with sufficient cold proof spirit; the mixture should measure about 40 degrees below proof. F is a specimen of a very young example of a very rare species of frog, prepared in this medium, and mounted in chloralized glycerine. G is another example of a moderately sized frog, mounted in weak spirit, which is a better mounting medium. We have now two processes, one a splendid colour preserver of very limited use, the other an excellent preservative for very delicate objects, but not a preserver of any bright colours, although for dark tints it does very well. I now come to a very difficult subject—What is the action of the gum and glycerine? I have long thought and even reported in one of my administration reports, that the gum was the colour preserver, and that the glycerine acted first by dehydrating the animal, and then by excluding air and water. I was led to this conclusion by the fact that the addition of water destroyed the colours, as I imagined, by again extracting the gum from the tissues. But I am now convinced this is not the case; the action of the gum is to harden the tissues against the softening influence of the glycerine; the real colour preserver is the glycerine, and it preserves because it excludes air and water. Amongst some fish presented a great many years ago by Mr. Bell, was a specimen of a red sea perch (specimen H) in arrack, which had a bit of its bright red colour left where it was tightly pressed against the glass. This specimen had always had a great fascination for me, as it is a species in which the colour fades in a few hours. The idea of finding some process by which animals would be shut up in some kind of solid led me to try hardened Canada balsam. J, a telyphonus, mounted in a solid glass made by evaporating Canada balsam to dryness and then re-melting it, and pouring it over the animal. The heat, however, is too great to make it an available process, and the exhibited specimen is the only success I ever obtained. It was prepared in 1883. Now, the fact is the glycerine, by excluding air and water, does act as a solid glass, and the only influence at work to bleach the specimen is light, which, curious to say as the exhibited specimen shews, does not seem to have much effect. A has been exposed to the full influence of a tropical light ever since 1884. Reflecting on this action it occurred to me, if the exclusion of air and moisture is the great ideal to aim at, could not some substance of a lighter specific gravity than glycerine be found? Why not some kind of oil? and of course in Ceylon cocoa-nut oil first suggested itself. But cocoa-nut oil, far from being likely to be a preservative, would require preserving itself. How was this to be done? Would carbolic acid mix with it? I found on experimenting that carbolic acid mixed with it in all proportions. There was, of course, no idea of using this as a preservative, the specimens must be first prepared. Very fluid arsenic paste was used for silvery fish with some success, and reduced gum and glycerine and gelatine—of which K is an example—were also tried; but from the very first it proved a very refractory mounting medium. It was very difficult to get a sufficiently white oil to begin with, and when I did, it always had a strong tendency to discolour. Time has proved I need not have troubled myself; it cannot be used as a mounting medium as mixtures of carbolic acid and glycerine, or cocoa-nut oil, attain a deep colour in time, irrespective of any animal matter in them. L shews the action in the case of glycerine; M in the case of oil. You will see in this latter case that the toad is in splendid preservation, and the fluid bright and clear, but the colour is very objectionable. Whole cases filled with bottles of this tint would be very ugly, although if the animals and their colour were well preserved, they might be more instructive than ordinary specimens. There was, however, another difficulty; a very fine cobra, well hardened in spirit after some months, broke down from no apparent cause; it was also found impossible to get a common blood-sucker mounted in this medium. Neither gum and glycerine, nor strong spirit, nor arsenic paste, nor anything else could keep them. In fact the medium appeared either not to be safe or not universally applicable. In order to study it and learn what its action really was, I preserved a blood-sucker in it direct, without previous preparation of any kind, and found that I had a preservation of form as good as any known, and of colour as good as gum and glycerine itself. In this case the carbolic acid is either the dehydrater, or perhaps combines with the tissues and preserves them, whilst the oil acts as the atmospheric excluder; and now you will see why difficult subjects such as cobras and blood-suckers, previously prepared, broke down. The tissues had absorbed from the alcohol or arsenic paste, or reduced gum and glycerine, a large proportion of water, in addition to that naturally contained in them, and consequently more than the carbolic acid could extract or combine with, the result being that they had an atmosphere, so to speak, of their own, which finally led to their more or less speedy decay. Here is then a splendid medium for the zoologist, especially in a hot climate. He is furnished with a powerful and easily used preservative both for form and colour which does not evaporate. N, the leg of a fly laid on a glass slide in a drop of oil, and just simply covered by an ordinary microscopic glass cover, has remained in the same state for 18 months. I need not say what a boon this would be to the microscopist who, whilst wishing to study some subject, did not wish to mount his specimens permanently. But with all these advantages it is of little use for public exhibition, and I need scarcely say this was a great disappointment to me. The spider question solved my difficulties (at least, I hope so) once more. I noticed how exceedingly hard some spiders had become in the oil, when it occurred to me that specimens that had become so firm would resist the dehydrating action of glycerine; and that if spiders would, anything would. The experiment was at once tried—the large rat snake, seven feet long, some frogs, and the fish coloured and uncoloured, will show you with what success. There are also a few spiders exhibited. The oil is also an admirable preservative for large fish skins that can be mounted afterwards. They require no varnishing and retain much of their lustre, and a large sea perch is exhibited prepared in this way. I have now merely to read the recipe.

Add carbolic acid to cocoa-nut oil till the oil marks 10 to 20 degrees below proof on an hydrometer. The more acid the more powerful the dehydrating effect, and judgment must be used. In this climate it is best, although not absolutely necessary, to remove the entrails. Place the specimen, carefully wrapped in rag, in plenty of this preparation. If wanted to mount for show, drain off the superfluous oil and mount in glycerine.

No. VII.—THE POISON OF THE TOAD.

Mr. W. B. Tegetmeier, writing in the *Field* on 12th September, 1891, says:—

A very interesting correspondence has lately taken place in the columns of the *Lancet* respecting the precise action of the poisonous secretion in the glands of the skin of the toad. Dr. T. Lauder Brunton has given some very useful details. Passing over the snakes, in which the poison is secreted by a modified salivary gland, he states that in the toads and salamanders, the poison is secreted by glands in the skin, and it may be obtained for examination by scraping them with a blunt metallic implement. In the toad the secretion is thick, yellow, and adhesive. It retains its poisonous character when dried for at least a year, and possibly longer. As a poison it does not appear to be particularly virulent when it is taken into the stomach of another animal, such as a rabbit or dog; but injected into a wound it is very active, and causes ulceration or mortification at the point where it is injected; and it also produces vomiting, convulsions, paralysis of all the voluntary muscles, and uncertain gait which follows such a state of things.

It is noted that all toads are not equally poisonous. The Italian toad, which closely resembles, if it is not identical with, our Natter Jack—the toad distinguished by a yellow line down the centre of the back—appears to be more poisonous than the French species, which is identical with the common English toad. In Moquin-Tandon's "Elements of Medical Zoology" a good deal of information may be found regarding the poison of the toad. Finches and linnets inoculated with it will die in about five or six minutes. Even dogs and goats, under whose skin small portions of the poison are injected, usually die in less than an hour, the excitement which is produced in the first instance being followed by depression, vomiting, convulsions, and death. This poison is fatal to frogs, even if only placed upon the back of these animals, but on the toads themselves it has no action. A dog, as is known, will seldom attack a toad a second time, and some have been known to be killed by simply biting one.

Dr. Lennard Guthrey states that the attack of his own dog on a toad was followed instantaneously by the most profuse salivation, violent vomiting, and subsequent collapse. He also states that the secretion has, in the case of some persons, a powerful action on the human skin. He relates that, after carrying a toad in his hand for some distance, he himself experienced a most disagreeable sensation of numbness and tingling in the fingers and palms of his hands, which became swollen, stiff, and extremely dry—a condition which remained for some hours; and he says he had heard that German violinists, when suffering from moist hands, are accustomed to check the perspiration by handling live toads.

It may interest our readers to know that toads are found in all parts of the world except Madagascar, Australia, New Guinea, and the Pacific Islands. Mr. Boulanger informs us that ninety distinct species of toads, constituting the genus *Bufo* of naturalists, are known. They extend from the sea coast to an elevation of 15,000 ft. in India, at which height the common Natter Jack was found by Stoliczka. Mr. Boulanger, in his valuable monograph on the reptiles of India, records that the common Indian species, *B. melanostictus*, ascends the Himalayas to a height of 10,000 ft. In Europe two species are found. One is the common toad (*Bufo vulgaris*), which in this country is about 3¼ in. in length, but which becomes much larger in the warm countries in the south of Europe; specimens from the Morea are said occasionally to measure 10in. in length. This species is found all over Europe, in Great Britain, but not in Ireland. The other European toad is the Natter Jack (*B. kalamita*,); this may generally be distinguished by a bright yellow line running down the middle of the back. It is found in drier situations than the common species. It occurs in some of the heaths near London, is said to be present in a few localities in the south-west of Ireland, and is abundant in Italy and Sardinia. I presume, therefore, that it is the species which Dr. Brunton says is more poisonous in Italy than in colder climates.

It is to be remarked that scientific men, although prone to dogmatise, are not necessarily wiser than the rest of the world. Fleming, in his well-known History of British Animals, maintains that the toad is destitute of any venomous quality, and is only despised, hated and persecuted by the ignorant; and he remarks that it is surprising that prejudices so unjustifiable still continue to prevail.

No. VIII.—TIGERS IN SUMATRA.

The following letter appeared in the *Field* signed by Tuan Kechil on 21st November, 1891 :—

During my residence on the north-east coast of Sumatra, in 1885-86, the country swarmed with tigers. So far from being driven away by the settlement of the country, they seemed more numerous about the tobacco plantations than in the jungle; for the reason that the tiger prefers the lallang grass and young jungle which springs up where the tobacco fields are left fallow; and this, now that the tobacco industry has fallen upon evil days, is more plentiful than ever. But, though new tracks could be found everywhere, it was rare to see one, and still rarer to hear of one being killed.

For some reason, the tigers of this side of the Straits, though they attain a great size, are not nearly so dangerous as those of the Malay Peninsula. I can only remember three cases of man-eating, and a few head of cattle destroyed. They are, however, very fond of dogs, which I have known them to carry off from a verandah in broad daylight, as the owner sat within a few feet. I should think (though I never saw it tried) that a noisy pariah tied up on a moonlight night would ensure a shot in a very short time to anyone who could stand being half eaten by mosquitoes. The natives have not much dread of the tiger, and account the black Sundanese leopard much more dangerous; but this beast is very scarce in the low country.

Elephants were plentiful along the coast from Langkalt to Assahan; indeed, at a place called Bobongan, they were a perfect nuisance, by breaking down bridges and treading in drains; and deer, tapir, orang-utan, pig, and the Malayan bear, besides rhinoceros, were abundant. But the fact is, that the work of the tobacco plantations is so incessant and heavy that no one engaged in it has leisure for sport; and the majority are Germans, Swiss, and Dutch, who prefer their everlasting cards, gin and bitters, and "randi bazi."

There are, however, formidable difficulties in the way of sport in this part of Sumatra. In the first place, a knowledge of colloquial Malay is indispensable; in the next, there is no such thing as a native shikari. The Malays are not fond of anything that requires more exertion than fishing, and do not care for going into the jungle; besides which they have no inducement to hunt game, most of which is unclean to Mussulmans. The Bataks have no such scruples, but they will only hunt when they are hungry, and they are most repulsive in their persons and customs, some being still cannibals.

The greatest obstacle to sport is in the nature of the country itself and the denseness of the jungle, which growing from a clay soil under drenching rain and a vertical sun, is about as unpleasant and unhealthy a place as can be imagined. I myself, like Mr. Hannibal Chollop, have the luck to be "fever proof, likewise ager;" but I retain the most unpleasant recollections of the hot, gloomy, malaria-reeking "payas," or swamps, where you waded all day knee deep in filthy mud and water, except when you tumbled over head and ears in it; while the perspiration streamed from every pore, and all things appeared through a mosquito haze—besides leeches which sucked, and ratan lawyers which clawed like cats. I do not mean to say that all the country is as bad as this, but it is the sort of place you would have to go to, and stay two or three days in, if you wanted to get near a rhinoceros or an elephant, or an orang-utan; and you may reckon on fever as a certainty anywhere, sooner or later.

There is, however, a good chance to get sport and reputation for anyone who likes to run the risk of visiting the unexplored mountains of the Gayu and Allas, in the interior, at the back of Langkat. These tribes (who in appearance and arms much resemble the Lushais) have a very evil repute for treachery and ferocity; and the Dutch are (or were in my time) very much opposed to any attempt being made to visit their country. But this probably means that the natives will not put up with the fraud and bullying which too often characterise Mynheer, and Meinherr, and Mossoo too, in their dealings with natives, for a large number were employed on English-owned estates, and gave no trouble. Some of these men have told me that their chiefs would not object to a white man visiting their country, as long as they were certain he was not Dutch. Their country, however, borders Acheen, which is closed to all Europeans. They say that they have abundance of wild cattle, very large and savage, besides plenty of tigers and elephants; and that it is good country to walk in, not like the "tanah busuk" (rotten country) of the coast. I suppose these accounts must be discounted a little, for, like other Orientals, they tell you what they think you want to hear; but if anyone would like to try it, I will give him all the information I have.

No. IX.—"HAS THE BAKRI A KEEN SENSE OF SMELL?"

The following incident sent to the Journal, by Mr. H. M. Hewett, may be of interest to the Members.

"H. and I went out from Khandala on the 14th of December last to the Sukkapatar jungles, with the usual number of coolies, and expecting to obtain the usual amount of shikar.

However, luck favoured us, and one of our men brought back news of a panther kill close by. We went up and found that it had killed a fine young cow in calf. As beating for the panther was impossible, we rigged up a *machan* on an adjacent tree, and got into it about 4-30 in the afternoon. After we had been seated about ten minutes H. spied two bakri coming out into the glade from the surrounding jungle. The first bakri walked up towards the kill, and then, when about 70 yards away, lay down in the shade. The second one fed right up to where we were sitting and then sauntered back and disappeared. As he was leaving, the panther—a fine sturdy male-appeared, looked round for a little and then came forward and sat down under a tree. The bakri which had been lying down now got up and fed towards the panther, to within 15 feet of the spot where it was crouching.

The panther let the bakri pass and as it disappeared slowly in the jungle, he got up and looked at it, yawned, and came on towards the kill. He walked past the kill simply sniffing at it and would have gone under our tree, but H. who had the first shot planted a ball in his head, and the fun was over.

My reason for sending you this account is that I have always been led to believe that deer and antelopes had such a keen sense of smell that it would be impossible for them to approach within five yards of a panther without being made aware of its presence. It is true there was little or no wind that evening, and the bakri was between the panther and the kill.

Possibly other sportsmen have had similar experiences, and I for one should be much indebted for any information on the subject."

No. X.—THE TEMPER OF ANIMALS.

The old theory that animal good-temper might be accounted for on the ground that animals are sensible of pleasure and pain, but not of advantage and disadvantage, was only a half-truth, for animals are subject to jealousy, and jealousy is the direct result of a feeling of personal disadvantage. But it draws attention to the fact that occasions for disagreement in the case of most animals are rare and unusual. Questions of domicile are almost the sole ground of discord in the animal world, with the exception of the fierce dissensions raised at pairing-time, and even in the last case combat is only general in the case of polygamous animals. Deer fight more fiercely than wolves, and wild sheep than lions; and though there is, or was, an eagle in the Zoo which was caught locked in the talons of another eagle when fighting in the spring, the fiercest birds are usually friendly with their own species, and while ruffs and black-game fight like gladiators for their wives, the eagles and the peregrines as a rule mate in peace. Proximity, the severest trial to human temper, seldom ruffles the animal mind, and different species live in harmony together, each seeming, as in the case of the owls and the prairie-dogs, or rooks and starlings, rather to prefer than shun the society of the other. The choicest spots for homes are naturally the source of warfare among birds, and other animals frequently fight for the possession of some favourite breeding-place. Badgers and foxes which have shared the same earth during winter often fight for sole possession in the spring, when the fox invariably wins, a result which would hardly be expected from the relative physique of the two animals. But such quarrels are only for the sake of rearing their young, not for selfish reasons; and even apprehended pressure on the food-supply rarely excites ill-will, except in the case of the largest carnivorous birds and animals, which require a wider range for hunting, and drive their young to other districts. The rodents and ruminants are less jealous; and that strong social and gregarious instinct which the existence of ill-temper as a permanent characteristic would inevitably destroy, keeps them together in peace and harmony. They love society, and not the least marked difference between the temperament of animals and men, is that animals do not by mere contact irritate each other,—a positive and not unimportant compensation for the absence of the gift of speech.

Since occasions of difference are so few, nothing but the assumption of an ancient and inbred malignity in animal minds, such as the author of "Three Men in a Boat" supposes in the case of fox-terriers to have been due to a double dose of original sin, could justify the view so generally held that animals are, as a rule, ferocious and ill-tempered. The exact contrary would be nearer the truth. Animal temper is naturally pacific, equable, and mild. Bad temper is the privilege of more highly organised natures; and the mild resentment of the placable tiger finds its development in the apoplectic fury of the mandril and the measured malice of mankind. Horace's suggestion, that Prometheus added to the ill temper of man the strength of a mad lion, must be taken literally. The general law of good-nature in the animal world makes the exceptions all the more remarkable. Quarrelsome species appear among a friendly tribe, just as an ill-tempered individual does in a kindly species. The ruminants are a most peaceful race, yet deer are savage, and so is that handsome Indian antelope the nylghau. A tame stag is a very dangerous pet, and even the beautiful roebuck has been known to kill a boy in a wild fit of rage. But the fiercest and most vindictive of all, with the exception of the Cape buffalo, is the South African gnu, which never loses its ill-temper when tamed, and always remains among the few dangerous animals which the keepers at the Zoo have to deal with. Hardly less ill-tempered are the zebras and the wild asses, which suggests that human mismanagement is not entirely to blame for the occasional ill-temper and obstinacy of mules and donkeys. To the ill-tempered species we may add the camel and the two-horned black rhinoceros. The last is really ferocious, charging down on any creature, man or beast, without provocation, and capable of inflicting mortal wounds even on the lion, the elephant, or its own kind. But among all the larger creatures of the animal kingdom, it is difficult to find more than a dozen species which are, as a class, ill-tempered, unless we include all those carnivorous animals which exhibit a certain ferocity in the capture of their prey. But it will be found that, apart from this law of their being, such animals are not, as a rule, either ill-tempered or malicious. On the contrary, their natural bias is towards good-nature, and it may be inferred that the fierceness exhibited by them when actually striking their prey, is rather a gradual development from a particular necessity than an essential part of their nature. The good-humour of the lions and other *Felidæ* was well illustrated by a scene at the Zoo a few weeks ago. The young lion from Sokoto was much intent on breaking in the iron shutter which separates the house it now occupies from its former quarters next door. Apart from the very proper wish to assert a right to its former domicile, it had the irritating stimulus supplied by an ill-tempered and decrepit old leopard which was growling on the other side of the shutter, and even went so far as to insert one of its longest teeth into the crack between the shutter and the wall, as a reminder to the lion of what was waiting for it on the other side. The lion was striking constant heavy blows on the door, and was so intent on its occupation as to disregard the call of its keeper. The keeper quietly attracted its attention by pulling its tail!—and the lion at once desisted, rubbed its face against the keeper's hand, and lay down to be stroked, patted, and have its mane caressed. A very beautiful puma close by exhibited all the pleasure of a friendly cat at being stroked, and the tiger from Turkestan allowed itself to be fondled like a big dog.

That good-tempered races contain very ill-natured individuals, raises the difficult question of temperament. A good authority on horses, Mr. Mayhew, endeavours to show that ill-temper among them is accidental, not innate. In his work, "jibbing" is shown to be due to brain-disease, shying to defective vision, and temper to the mismanagement of man. There is much truth, but also much error here. Those best acquainted with the nature of domesticated animals know how greatly the temperaments of individuals differ. Take, for instance, the case of three highly bred young Jersey heifers, of which the writer has watched the up-bringing from their earliest days. They have never been frightened or struck; they have not even heard a rough word from their earliest days, even when they jumped the garden-fence and browsed on an apricot-tree. One is as gentle and domesticated as a well-bred cow can be, the others are ready with their horns at any or no provocation. The same is true of horses: some are so ill-tempered that they will kick or bite at any living thing that comes near them. It is as impossible to trace these dislikes to any known cause as it is to find a reason for the antipathy which cows have for hares. However great our liking for horses, we cannot deny that some of the best thoroughbreds are revengeful, quarrelsome, and liable to frightfully sudden fits of rage. No doubt this evil temper is often accompanied by splendid qualities of endurance. Chestnut horses, which have generally the most uncertain tempers, are perhaps the most high-couraged. But courage and temper are not always allied; and temper and human management are not necessarily connected. 'Bendigo' and 'Surefoot' were both trained in the "Seven Barrows" stable by the late Mr. Jousiffe, who always avoided any severity of treatment, and never ran his horses "light." Each as a three-year-old won a great race, 'Bendigo' the Cambridgeshire, 'Surefoot' the Two Thousand Guineas. Both carried off the Eclipse Stakes at Sandown, worth £10,000, later in their career. Yet 'Bendigo' had a perfect temper, while 'Surefoot's' is well-known to be ferocious. 'Bendigo' would train himself, and however well he ran in trials on the White Horse Hill, his trainer knew that he would do still better on the race-course. In his last race, when he was just beaten when carrying a crushing weight, Watts gave him one stroke of the whip. But the horse was doing all he could, and the jockey did not touch him again. In the stable, the big brown horse was almost as friendly with strangers as he was with his devoted attendant, "Bendigo Pat," and the writer has seen no prettier sight than that of his trainer's little daughter hugging "dear old 'Bendy's'" nose. The horse had the courage and gentleness of a knight of romance. 'Surefoot,' on the other hand, under identical treatment, was dangerous in the stable, and savage even when running. In the actual race for the Derby, he tried to bite the jockeys on the horses in front of him, and when being put into the horse-box for the journey, gave more trouble than a Murcian bull. Yet this savage temper was not accompanied by unusual courage and endurance, and in severe races the even-tempered 'Bendigo' was his undoubted superior. 'Peter,' another race-horse noted for his stubborn obstinacy, once gave an interesting object-lesson in temper as between man and horse, at Ascot. The horse fought with his jockey (Archer) for twenty minutes at the post, but the indomitable good-humour of the jockey won. When the flag fell, the horse went off with a rush, but stopped in the middle of the race to kick. Archer neither moved nor struck him, and 'Peter' then went on like the wind, and won! But horses of this temperament are the exception, not the rule; and the success with which we have developed power and courage, without producing animals like 'Cruiser' or the celebrated 'General Chasse,' of whom his owner, Mr. Kirby, the dealer, who sold largely in Russia, used to say that "the Emperor Paul was nothing to him," is one of the triumphs of domestication. The union of reckless courage and habitual ferocity is rare in the animal world, and the general law of good-nature remains absolute and unquestioned.

(The above article, which appeared originally in the "Spectator" on 12th December, 1891, has been reproduced here for the benefit of our Members who may not have seen it, as it raises several very interesting points which are worthy of the careful attention of all students of Animal Life, especially in this Country.—Ed.)

XI.—THE CRESTED GREBE BREEDING IN INDIA.

I beg to record having found a nest of the Crested Grebe (*Podiceps cristatus*) on a tank near here in August last, containing three eggs, one of which I send for the Natural History Society's Collection. I also send the skin of the bird, as it is, I believe, the first time the Crested Grebe has been found breeding in India.

Kharaghora, December, 1891. H. BULKLEY.

PROCEEDINGS.

PROCEEDINGS OF THE MEETING HELD ON 8TH DECEMBER, 1891.

The usual meeting of the members of this Society took place on Tuesday last, the 8th December, Doctor D. MacDonald presiding.

The following gentlemen were elected members of the Society :—Mr. Charles Gray

(Coonoor); Surgeon-Major James Armstrong (Cawnpore); Mr. O. Wolfe Murray, M.C.S. (Cuddapah); Doctor H. F. Cleveland (Raipur); Colonel M. Bowie (Raipur); Mr. F. G. Sly, B.C.S. (Raipur); Mr. Henry Wapshare (Nilgiris); Captain G. Carew (Mhow); Mr. Abdullabhoy Rahimbhoy (Bombay); Mr. E. F. Allum (Bombay); Captain R. D. Pyrke (Colaba); Veterinary-Captain James Mills (Bombay); Captain E. Hibbert (Mount Abu); Doctor H. McCalman (Dharwar); Mr. James H. Taylor (Orissa); Mr. H. O. Quin, C. S. (Ahmedabad); Mr. A. E. Shuttleworth (Cachar); Captain E. Lindesay (Kamptee); Mr. H. O. Campbell (Bombay); Mr. H. G. Gell (Bombay); Dr. C. H. L. Meyer (Bombay); Mr. Jivanjee Jamshedjee Modi (Bombay); Mr. Harry John (Bombay); Mr. J. C. Bergendahl (Bombay); Mr. S. Eardley-Wilmot (Naini Tal); Mr. Rahimtoola Khairaz (Bombay); Mr. W. C. Rand, C.S. (Bombay); Mr A. E. Wild (Lahore); Mr. W. M. Fletcher (Poona); Mr. David P. Masson (Lahore); Lieut. H. M. Biddulph (Bareilly); Mr. C. R. Cleveland, C.S. (Saugor); Mr. H. B. Anthony (Raipur); Doctor A. Lankester (Amritsar); Lieut. F. C. L. Waller (Sehore); Mr. James R. Bapty (Bombay); Monsieur A. Sada (Pondichery); Mr. L. A. Macaulay (Bombay); Moulvi Syed Ali Belgrami (Hyderabad).

The following contributions, received since the last meeting, were acknowledged :—

Contributions from September to November.

Contribution.	Description.	Contributors.
1 Python (alive)…. ………	Python molurus………… .	Col. W. S. Hore.
1 Palm Civet (alive) ………	Paradoxurus musanga ……	Mrs. M. Navin.
1 White Booby ……………	Sula cyanops …………………	Mr. T. Thorburn.
1 Chameleon (alive) ………	Chameleo calcaratus …….	Mr. E Flower.
1 Owl (alive) ………………	Strix javanica………………	H. H. the Thakore of Wadhwan.
1 Snake ……………………	Lycodon aulicus……………	Mr. Pearson.
1 Black Lemur (alive) ……	Lemur macaco ……………	Miss Hart.
3 Chameleons (alive) ………	Chameleo calcaratus………	Col. W. Scott.
1 Snake ……………………	Silybura macrolepis ………	Mr. C. E. Kane.
1 Python's skin ……………	Python molurus …………	Lieut. T. Woodhouse.
Climbing Fish ….. …………	Glyptosternum sp. ……. …	Mr. A. Hill.
2 Snakes ……………………	Cynophis helena …………	Major W. P. Kennedy.
1 Snake .. …………………	Dendrophis picta …………	Do.
Some birds' Eggs …………	from Secunderabad ………	Mr. W. Gaye.
1 Python's skin ……………	Python molurus …… ……	Mr. H. F. Silcock, C.S.
1 Palm Civet (alive) ………	Paradoxurus musanga ……	Mr. A. Elliott.
1 Snake ……………………	Lycodon aulicus… ………	Mr. W. Thacker.
1 Cobra………………………	Naga tripudians……………	Col. Merewether.
1 Cockatoo (alive) …………	Plictolophus galerita …….	Capt. Houston.
1 Crocodile skin ……………	Crocodilus palustris ………	Capt. Sutton Jones.
1 Burmese Python (alive)…	Python reticulatus…………	Major C. T. Bingham.
1 Snake…… …………………	Gongylophis conicus………	Mr. J. S. Orton.
1 Cobra…… …………………	Naga tripudians ……… …	Mr. C. E. Kane.
1 Glossy Ibis ………………	Falcinellus igneus ……….	Mr. Sibbold.
2 Porcupine fishes …………	Diodon hystrix ……………	Miss Atkinson.
1 Snake………………………	Tropidonotus quincunctiatus ………………………	Mr. H. Buckland.
1 Snake………………………	Ptyas mucosus ……………	Mr. E. Ingle.
1 Ghorpad (alive) ….. …..	Varanus bengalensis………	Doctor Meyer.
1 Lizard (alive) ……… …..	Uromastrix hardwickei……	Do.
1 Large Egret ………………	Herodias torra ……………	Mr. N. S. Symons.
1 Short-eared owl (alive) …	Asio accipitrinus …………	Purchased.

Contribution.	Description.	Contributors.
1 Large Stone Plover	Esacus recurvirostris	M. E. L. Barton.
1 Daboia	Daboia elegans	Lieut. F. C. Waller.
A number of Shells	Indian Ocean	Capt. E. Shopland.
Various Horns	From Assam	Mr. J. M. Kyrie.
1 Hooded Crow (alive)	Corone cornix	Doctor Grogan.
1 Pair of Antlers	Rucervus eldii	Capt. A. Gwyn.
1 Mohaul Pheasant	Lophophorous impeyanus	Lieut A. Newnham (10 Bo. I.)
1 Eastern Solitary Snipe	Gallinago solitaria	Do.
2 Striated Jay Thrushes	Grammatoptila striata	Do.
1 Large Brown Thrush	Zoothera monticola	Do.
1 Indian Cuckoo	Cuculus micropterus	Do.
1 Hymalayan Whistling Thrush	Myiophonus temmincki	Do.
1 Ward's Pied Blackbird	Turdulus wardii	Do.
1 Small Billed Mountain Thrush	Oreocincla dauna	Do.
1 Collared Pigmy Owlet	Glaucidium brodei	Do.
1 Chestnut-bellied Rock Thrush	Oreocetes erythrogaster	Do.
2 Large Himalayan Accentors	Accentor nepalensis	Do.
2 Brown Hill-Wrens	Pnoepyga pusilla	Do.
1 Blue-fronted Redstart	Ruticilla frontalis	Do.
1 Dark Grey Cuckoo-Shrike.	Volvocivora melaschistos	Do.
1 Pied Stone Chat	Saxicola picata	Do.
1 Bare-footed Scops Owl	Ephialtes gymnopodus	Do.

MINOR CONTRIBUTIONS FROM :—

Mr. E. H. Elsworthy, Mr. H. Rowbotham, Mr. E. C. Monod, Mr. H. Spooner, H. H. the Maharaja of Dharampur, Mr. Chester Macnaghten, Mr. W. Webb, and Mr. J. C. Parmenides.

CONTRIBUTIONS TO THE LIBRARY.

Journal of Comparative Medicine and Veterinary Archives, Nos. 8 and 9, in exchange; Records of the Geological Survey No. 3, in exchange; The Forester, Nos. 8 and 9, in exchange; Proceedings of the Royal Society of Edinburgh, in exchange; Linnæan Society of N. S. Wales, Vol. VI., Part I., in exchange.

ACHATINA FULVA.

Mr. Chester Macnaghten exhibited a fine specimen of *Achatina fulva* which he found in his garden at Rajkote, Kattywar, during last monsoon. This handsome land-shell was introduced from Mauritius by the Conchologist Benson into Calcutta, whence it has been dispersed throughout the country, probably by the agency of gardeners.

THE SOCIETY'S JOURNAL.

The Honorary Secretary explained that the publication of No. 3 of Vol. VI. of the Society's Journal had been delayed owing to the coloured plates not having been received from England. The illustrations for No. 4 had arrived, so that the two numbers would both be published shortly.

AN ANTIDOTE FOR PHURSA BITE.

Dr. W. Dymock read an interesting paper on the value of the plant Pangala (*Pogostemon parviflorus*) in cases of bites from the Phursa Snake (*Echis carinata*), giving a description of the plant, and quoting many cases in which the antidote had been administered with success. Dr. Dymock stated that the roots of the plant had been examined by Dr. Warden, the well-known Professor of Chemistry, at the Calcutta Medical College, and that the most interesting principle detected in the root was an alkaloid which Dr. Warden proposed to call *Pogostemonine.* He had also detected the presence of *Trimethylamine*, and a volatile principle with a cedarwood odour. Resinous principles were also present, with astringent matter. The constituents of the plant, which should be used in any future experiments, are the alkaloid *Pogostemonine* and *Trimethylamine*, the amount of tannic matters present being insufficient to account for any remarkable styptic properties.

(The paper will be found on page 450.)

NIDIFICATION IN KANARA.

The next paper read was by Mr. J. Davidson, of the Bombay Civil Service, containing some important notes on the nesting of birds in Kanara.

MISCELLANEOUS NOTES.

The following miscellaneous notes received from the undermentioned members were also read :—

Snipe shooting in the neighbourhood of Secunderabad, by W. Gaye.

Taming a Heron, by Lieut-Col. W. S. Hore.

Memory *versus* Reason in Cats, by Col. Kenneth Mackenzie.

The Breeding of Snakes, by H. S. Ferguson.

How the Ghorpad defends itself, by Geo. Wasey.

LIST OF BOOKS*

IN THE POSSESSION OF

The Bombay Natural History Society, on 31st December, 1891.

MAMMALIA.	*Books.*
Histoire Naturelle des Mammiferes, (*Gervais*)	1
Mammalia of India, (*Jerdon*)	1
Natural History, Mammalia, (*Wood*)	1
The Anatomy of Vertebrates, Mammals, (*Owen*)	1
Catalogue of the Mammalia in the Indian Museum, Calcutta, Parts I., II.	2
The Amphibious Carnivora and Herbivorous Cetacea, (*Hamilton*)	1
History of Mammalia, Vols. 1-6	6
Wild Animals, (*Notts*)	1
Mammalia of India and Ceylon, (*Sterndale*), 2 copies	2
Denizens of the Jungle, (*Sterndale*)	1
Game and Wild Animals of South Africa, (*Harris*)	1
Fauna of British India, Mammalia, (*Blanford*), Parts I.-II., (2 copies)	4
Carried forward......	22

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* Additions to the Society's Library are much needed.

	Books.
Brought forward	22
Catalogue of the Mammals in the Museum of the East India Co	1
Mammals, Living and Extinct, (*Flower*)	1

BIRDS.

Genera of Birds, (*Gray*)	1
Encyclopedie d' Histoire Naturelle,—Oiseaux	6
Monograph of the Scansorial Barbets, (*Marshall*)	1
Monograph of the Sun Birds, (*Shelley*)	1
Manual of the Birds of New Zealand, (*Buller*)	1
Game Birds of India, (*Jerdon*), 2 copies	2
The Birds of India, (*Jerdon*), 2 copies	6
Birds' Nesting in India, (*Marshall*)	1
The Avifauna of British India, (*Murray*), 2 copies	4
The Game Birds of India, Burmah and Ceylon, (*Hume and Marshall*)	3
The Edible and Game Birds of British India, (*Murray*)	1
American Ornithology, (*Wilson and Bonaparte*)	3
Catalogue of the Birds in the Lucknow Museum	2
Siberia in Europe, (*Seebohm*)	1
My Scrap Book, (*Hume*)	1
Fauna Japonica-Aves, (*Siebold*)	1
Nests and Eggs of Familiar British Birds, (*Adams*)	1
A Monograph of the Jacomars and Puff-Birds, (*Sclater*)	7
Birds of South Africa, (*Layard* and *Sharpe*)	1
Birds of British Burmah, (*Oates*), 2 copies	4
Canaries and Cage Birds, (*Cassell*)	1
Parrots in Captivity, (*Greene*), Volls. I.-III.	3
List of the Birds of India, (*Hume*)	1
Foreign Cage Birds, (*Gedney*), Vols. I.-II	2
Monograph of the Birds of Paradise, (*Elliott*)	6
Catalogue of the Birds of the British Museum, Vols. I.-XII	12
The Ibis, from 1873-78	6
Fauna of British India, (*Oates*), Birds. Vols. I.-II., 2 copies	4
Catalogue of the Birds in the Museum of the East India Company	1
Birds of Bombay, (*Barnes*)	1
Catalogue of the Birds in the Lucknow Museum	1
Stray Feathers, (*Hume*), Vols. I.-XI	11
Nests and Eggs of Indian Birds, (*Hume*), Vol. I.	1
Land Birds of the Pacific District, (*Belding*)	1

FISHES.

Fishes of India, (*Day*), Vols. I.-II	2
Malabar Fishes, (*Day*), 3 copies	3
Fishes of Madeira, (*Lowe*)	1
Fauna Japonica—Pisces, (*Siebold*)	1
Carried forward......	13

	Books.
Brought forward......	130
Freshwater Fishes of India, (*Beavan*)	1
The Rod in India, (*Thomas*)	1
Notes on Fish and Fishing, (*Manley*)	1
Indian Fishes, (*Russell*), Vols. I.-II.	2
Fauna of British India—Fishes, (*Day*), 2 copies, Vols. I., II.	4
The Fishes of New Zealand, (*Hector*)	1
A Revision of the South American Nematognathi or Cat Fishes, (*Eigenman*)	1
REPTILES.	
The Landmarks of Snake Poison-Literature, (*Richards*)	1
Destruction of Life by Snakes in Western India	1
Indian Snakes, (*Nicholson*)	1
Fauna Japonica—Reptilia, (*Siebold*)	1
The Thanatophidia of India, (*Fayrer*)	1
The Fauna of British India—Reptiles, (*Boulenger*), two copies	3
The Reptiles of British India, (*Günther*)	1
List of the Snakes in the Indian Museum, Calcutta	1
Notes on the Collection of Snakes in the Indian Museum, Calcutta, (*Sclater*)	1
OTHER INVERTEBRATES.	
The Aquarium Naturalist, (*Jones*)	3
A Manual of Mollusca, (*Woodward*), 3 copies	3
Fauna Japonica—Crustacea, (*Haan*)	1
Conchology, (*Crouch*)	1
Invertebrate Animals, (*Owen*), Vols. I.-II	2
INSECTS.	
Encyclopédie d'Histoire Naturelle—Papillons	1
Papillons Exotiques, (*Seligmann*)	1
Monograph of the Genus Callidryas, (*Butler*)	1
The Aurelian. English Moths and Butterflies, (*Harris*)	1
The Transformation of Insects, (*Duncan*)	1
Insects Abroad, (*Wood*)	1
Beetles, British and Foreign, (*Duncan*)	1
The Entomologist's Text Book, (*Westwood*)	2
Insect Transformations	1
Exotic Moths, (*Duncan*), two copies	2
British Moths, (*Duncan*)	1
Natural History of Bees	1
Oriental Cicadidæ, (*Distant*), Parts I.-IV.	4
Description of New Lepidopterous Insects, (*Hewitson and Moore*)	1
The Cabinet of Oriental Entomology, (*Westwood*)	2
Butterflies of India, Burmah and Ceylon, (*de Nicéville*), Vols. II.-III.	3
Catalogue of the Moths of India, (*Cotes and Swinhoe*)	1
Carried forward......	187

	Books.
Brought forward......	187
Text Book of Entomology, (*Kirby*)	1
Catalogue of the Lepidopterous Insects in the Museum of the East India Company	1
The Destructive Insects of Victoria, (*French*)	1
The Insect World, (*Figuer*)	1
Indian Silk Culture, (*Wardle*), 2 copies	2
The Wild Silks of India, (*Wardle*)	1
The Butterflies of Great Britain, (*Westwood*)	1
The Hesperidæ, (*Watson*)	1
Manual of New Zealand Coleoptera. (*Brown*)	2
The Canadian Entomologist (unbound)	1
The Modern Classification of Insects, (*Westwood*), Vols. I., II.	2

BOTANY.

The Fertilization of Flowers, (*Müller*)	1
The Plants and Drugs of Scind, (*Murray*), 2 copies	2
The Timber Trees of India, (*Balfour*)	1
The Useful Plants of the Bombay Presidency, (*Lisboa*)	1
First Book of Indian Botany, (*Oliver*)	1
Indian Ferns, (*Baynes*)	1
The Natural History of Plants, (*Ballon*)	7
The Vegetable Productions of the Bombay Presidency, (*Birdwood*)	1
A Glossary of the Vernacular Names of the Principal Plants in Bombay, (*Dymock*)	1
Catalogue of Ferns in the Government Herbarium at Saharanpur	1
Icones Plantarum Indiæ Orientalis, Vols. II.-VI.	5
Materia Medica of Western India, (*Dymock*)	1
Flora of British India, (*Hooker*), Vols. I -V.	5
Sagacity and Morality of Plants, (*Taylor*)	1
The Fertilization of Orchids. (*Darwin*)	I
Flora Forestiere de la Cochin Chine, (*Pierre*)	1
Lehrbuch des Pflanzen Physiologie, (*Detmer*)	2
Biologie der Pflanzen, (*Cohn*), Vols. I. IV.	4
Botanische Zeitung, Vols. I.-V.	5
Phormium Tenax	1
Ferns of British India, (*Beddome*)	1
The Indigenous Fodder Grasses of India, (*Duthie*), 1886-8	3
The Bombay Flora, (*Dalzell and Gibson*)	1
Pharmacographia Indica, (*Dymock*), Parts 2-4	3

GENERAL.

Zoological Atlas, (*Brehm*)	1
Western Yunnan Expedition, 1868-75	2
Carried forward	255

	Books.
Brought forward......	255
The Museum of Natural History, (*Cobbold*)	4
Large Game Shooting in Tibet, (*Kinlock*)	1
Atlas of Practical Elementary Biology, (*Howes*)	1
Rambles of a Naturalist, (*Collingwood*)	1
Two Years in the Jungles, (*Hornaday*)	1
A Dictionary of the Economic Products of India	5
The Calcutta Journal of Natural History	7
The Hand Book of New Zealand, (*Hector*)	1
Dictionary of Natural History, (*Beeton*)	1
Proceedings of the Linnean Society of New South Wales, 1886-89	4
Reports of the Smithsonian Institute	5
Taxidermy and Zoological Collecting, (*Hornaday*)	1
Manual of New Zealand History, (*Wallace*)	1
Life of Frank Buckland, (*Bompas*), 2 copies	2
Animal Lore of Shakespeare's Time, (*Phipson*)	1
The Malay Archipelago, (*Wallace*), 2 copies	2
Snakes, Marsupials and Birds, (*Nicols*)	1
Advanced Text Book of Zoology, (*Nicholson*)	1
The Utilization of Minute Life, (*Phipson*)	1
The Kashmere Hand Book, (*Ince*)	1
The Taxidermist's Manual, (*Brown*)	1
A Manual of Indian Sport, (*Mackay*)	1
Notes on Collecting and Preserving Natural History Objects, (*Taylor*)	1
The Animal Creation, (*Jones*)	1
Animal Locomotion, (*Pettigrew*)	1
Matheran Hill, its People, Animals and Plants, (*Smith*)	1
Chapters on Evolution, (*Wilson*)	1
The Sportsman's Hand Book, (*Ward*), 3 copies	3
Moses and Geology, (*Kinns*)	1
Astor, (*Liscomb*)	1
Variation of Plants and Animals under Domestication, (*Darwin*), Vols I.-II.	2
In the days when we went Hog Hunting, (*Brown*)	1
The Animal Kingdom, (*Rymer Jones*)	1
Natural History—Reptiles, Fishes, Molusca, (*Wood*)	1
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A Naturalist's Wanderings in the Eastern Archipelago, (*Forbes*)	1
Life and Letters of Charles Darwin, (*Darwin*), Vols. I.-III.	3
Carriedforward... ..	336

	Books.
Brought forward......	336
The Wanderings of Plants and Animals, (*Heyn*)	1
Odontology, (*Owen*), Vols. I. & II.	2
Practical Taxidermy, (*Brown*)	1
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Proceedings of the Zoological Society of London, 1878-91	17
Transactions of the Zoological Society of London, 1891	5
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Palæontologia Indica, (*Geological Survey*)	1
Records of the Geological Survey of India, 1886-91, Vols. XIX.—XXIV	5
Reports of the Geological Exploration in New Zealand	3
The Journal of Comparative Medicine and Surgery, Vols. II.—X.	9
Transactions of the Linnean Society of New York	2
Journal of Comparative Medicine and Veterinary Archives, Vols. XI.—XII.	2
La Nature, 1890-91	2
Prodromus of the Zoology of Victoria, Parts I.—XVII	17
Transactions and Proceedings of the New Zealand Institute, 19, 20, 23	3
Studies in Biology for New Zealand Students, Nos. 3, 4	2
Geological Survey of Victoria, 1877-80	3
Meteorological Report of New Zealand	1
Index to Reports of the Geological Survey of New Zealand	1
Report of Geological Explorations in New Zealand during 1888-89	2
Manual of New Zealand History, (*Wallace*)	1
Catalogue of the Colonial Museum Library, (*New Zealand*)	1
Victoria Naturalist, 1890-91	2
Indian Museum Notes, Vols I.—II.	8
Nature, Vols., I.—III	3
Systema Naturæ, (*Linneaus*)	1
Total...	516

Index to Volume VI.

Names of New Genera and Species have an asterisk (*) prefixed.

Specific Names are written with a small initial letter; Generic, Sub-family, Family, and Order Names are written with a capital initial letter.

PAGE
Abaratha 58, 394, 448
aberrans..........49, 369, 370
Abisara 43, 440
abseus 48
abyssinia 196
Acanthaceæ.......... 175
Acanthophippium 422
acaulis 172
Acesina 49, 369
Achatina 503
Achyranthes 260
aciculatus.......... 213
Acræinæ 437
Acridium 242, 245, 416
Acridotheres 91, 105
acte 50
Adiantum 165
adima 351, 352
adipala 39
Adolias.......... 352
adrastus 58, 448
adriana.......... 48
Æchmea 172
Ædicnemus.......... 25
Ægialitis..........21, 22, 131
ægyptiacum 190
æliamis..........46, 179, 366, 441
aënea 339
Aerides 172
Æridis 422
Aëromachus 447
Æsacus 303
æsiope 52, 319, 443
affinis 89
agallocha 400, 404
agallochum 404
agamemnon.......... 446
Agamidæ 102
PAGE
Agaricus 219, 222
aglea 435
agni 59, 384
agostina 51
Agrotis 233
Ailanthus 399
akasa 440
akool 139
alba..........95, 174
albicilia 391
albicollis 19, 106, 302
albidisca 440
albidus 192, 199
albifascia.......... 380
albigena 296, 299, 301
*albipectus 389
albonotatus 89
albo-picta 174
album 400
albus 174
*alemon 48, 371
alexis 447
*alida 394
Allamanda 422
almana..........28, 37, 438
Alocasia 170, 270
Aloexylon 404
Alophooxus.......... 60
Altingia 405
altissima ....347—349
Aluc[illegible]s..........60-63
alysos 382, 448
amabile 172
amantes 48, 180, 181, 370, 371, 442
amara 54
Amaryllideæ 171
Amaryllis.......... 171, 422
Amathusia 437

PAGE

*amatrix 48, 370
amba 350
Amblypodia 47, 180, 441
amboides 350
Ammodorcas 460
ammon 187
ammoniacum 400
Ammoperdix 6
amor 443
Ampittia 57, 447
Anas 94, 99, 290
Anastomus 151
anaxias 436
Anæctochilus 422
anæstheta 297, 301
Andropogon 64, 127, 189, 192, 193, 197, 201, 204—206, 210—215.
androgeus 53
Anemia 168
anglica 294
Angræcum 173
angulata 43, 181
angustifolius 192
angustifrons 416
angustirostris 291
anita 47
anna 354, 355
annulatus 67, 69, 203, 209, 210
anops 369
Antelope 184, 186
Anthericum 171
Anthistiria 217
Anthistria 218
Anthomyia 416
Anthurium 170, 422
antigone 129
Antilope 96
antiphates 445
antiquorum 285, 286
Apatura 36
Aphelandra 175, 422
Aphnæus 49, 182, 442
apicalis 29
Apluda 200, 218
Apocopis 193, 201
Apoderus 263
eppiades 40, 350, 352
Appias 53, 444
Apporasa 47

PAGE

Aquilaria 400, 404
Arachnechthra 337, 338
Arachnothera 337
aratus 366
arbor-tristes 479
Arbus 274
arcesilaus 345, 346
Archontophœnix 169
arcuata 94, 99, 442
ardates 45, 178, 441
Ardea 95, 142, 143, 147
ardeola 25
Ardetta 147—149
Areca 169
Aredeola 143, 146, 147
argentea 192
argiades 45, 178, 441
argoonda 93, 99
argoondah 8
argun 272
Argynnis 346, 349, 439
argyrostigma 174
Arhopala 27, 28, 47, 180, 181, 370, 442
aria 54, 447
ariadne 36, 437
*arisba 49, 369
aristata 218, 219
aristatum 197, 198
Aristida 213
aristolochiæ 53, 329, 330, 414, 415, 446
aristotelis 96
arja 42
armigera 240
arni 96
Aroideæ 169, 170
aromatica 400, 422
aromaticus 212
Arthraxon 190, 192, 193
Arum 270
arundinacae 171
arundinacea 190
Arundinæca 204
Arundinella 124
asiatica 7, 93, 99, 180, 337, 338
asiaticus 89, 141
Asinus 457, 467
Asparagus 171
aspera 260
Aspidium 168

PAGE
Asplenium ... 168
assamensis ... 56
asterie ... 28, 37, 438
Astictopterus ... 59, 395—397, 447
astola ... 38
aswa ... 35, 437
Atella ... 36, 438
ater ... 105
athamas ... 41, 410
athertoni ... 333
Athyma ... 40, 350, 439
atkinsoni ... 47
atilia ... 383
atlites ... 37, 438
atra ... 136
atrata ... 441
atrax ... 48, 181
atripennis ... 331
attenuata ... 39
atticus ... 448
atymnus ... 50, 182
augias ... 57
aurantia ... 106
aurantius ... 89, 336
aureas ... 374
aureo-striata ... 170
aureum ... 168, 173
aureus ... 96
aurifrons ... 62, 63
aurita ... 13, 94, 99
aurivittata ... 59
austeni ... 56, 388
australasica ... 172
avanta ... 35
avistata ... 200
avul ... 82
Axis ... 96
Azanus ... 44, 441
azurea ... 91

babulus ... 225
Bactris ... 169
Bacularia ... 169
bæticus ... 47, 179, 441
bada ... 55
Badacara ... 435
Badamia ... 54, 446
badra ... 446

PAGE
bailloni ... 140
balarama ... 350, 352
baldus ... 436
Balsamodendron ... 400
bambusæ ... 57, 447
Baoris ... 55, 390
Baracus ... 447
barbatulum ... 173
basiflava ... 448
*basiviridis ... 373
batassiensis ... 89
Batrachia ... 100
Batratherum ... 192, 193
Beesha ... 434, 437
Begonia ... 155, 174, 175
beisa ... 457, 466
bela ... 35, 36, 437
belangeri ... 168
Belenois ... 322, 324, 444
bengalense ... 400, 409
bengalensis ... 91, 130, 421
bennettii ... 96, 461
benzoin ... 400
bergii ... 298
bernardus ... 42
beturia ... 57, 390
bevani ... 56
bezoartica ... 96, 184, 186
bhagava ... 58
bhima ... 34
Bibos ... 223
biggsii ... 43
Bignonia ... 165
Bilbergia ... 172
Bindahara ... 443
binghami ... 32
binnatus ... 209
binotata ... 33
birostris ... 334
Bison ... 223
bladhii ... 209, 210
blasius ... 436
Blechnum ... 168
Bletia ... 173, 174
blewitti ... 93, 99
blumii ... 198
* bochides ... 365—367
bochus ... 46, 178, 367, 368, 441
boisduvali ... 43

PAGE
boisduvali 50
bolina 39, 412, 413, 438
bonassus 225
bonhami 6
bononia 392
Borassus 271, 272, 486
Bos 222—225
Boswellia 399,—401
Bovidæ 185, 222
Brachypodinæ 60, 61, 63
Brachypternus 336
Brachypterus 89
bracteatum 172
brasiliensis 168
brassolis 176
Brenthis 348
Bromeliaceæ 172
buasii 167
Bubalus 96
Bubulcus 143, 145, 147
buchananii 383
Bufo 495
bulbiferum 168
bulis 181, 442
bullata 168, 175
bungarus 103
Buphus 95
Burbidgeanitida 171
burmana 38
Butea 107, 273
butleri 396
Butorides 146, 147, 417

Caccabis 6
* cære 388
cærulea 365
cærulescens 374
cæruleus 213
Cæsalpinia 71
cæsium 169
caffer 225
cahira 56
Caladium 169, 270
Calamus 77, 169, 212
Calanthis 422
Calathea 171
Calathes 173
Calliana 377
callistus 365
Callosune 324, 325, 444

PAGE
calomelanos 167
Caloptenus 245
Calosoma 416
Calyptrogyne 169
Calysisme 344, 436
cambayensis 95, 99, 100
Camena 49, 442
camiba 438
camiba 4
* campbelliana 124
campestris 222
Campsidium 166
canace 41, 439
canaraica 388, 442
Canarium 400, 409
canaticutatum 190
candidus 132
canidia 51
canorus 90
cantianas 21
capillus 167
caprata 337
Caprimulgus 89, 331
carbo 304
cardamines 324
carderi 166
cardui 439
caricosus 208, 209
carinata 103, 450, 452, 454, 503
Carludovicas 169
Carpophaga 340
carticoides 350
caryophyllacea 290
caryotæfolia 169
caspia 293
Cassia 321, 485
Castalius 47, 179, 441
Catapæcilma 443
catherinæ 166
catilla 51, 319, 321, 444
Catochrysops 28, 46, 179, 441
catoleucos 393
Catophaga 52, 322, 444
Catopsilia 51, 319, 328, 444
Cattleya 172, 422
caudata 437
caudatum 167
caulesnsceamoena 168
cavatus 333

PAGE
Cedrus 400, 407
Celænorrhinus 58, 378, 382, 384, 448
celeno 366
celunda 397
centaurus 47, 48, 442
Centrosolenia 175
cephala 58
cerealella 238, 239
cernuum 216
cernuums 216
cernuus 216
certus 197
cerulescens 90
Cervidæ 185, 187
Cervulus 96
Cethosia 36, 438
ceylonica 436, 445, 447
chalybeia 375
Chamædorea 169
champaca 478
chandrana 443
Chapra 55, 388, 447
Chaptia 339
Charaxes 41, 440
Charus 446
Chaulelasmus 291
Cheilanthes 167
chela 43
chenui 436
Cheritra 50, 442
Chibia 269
Chilades 44, 176, 177, 440
Chilasa 446
chirurgus 134
Chliaria 50
chlorigaster 96, 99
Chloropsis 59
chloropus 138
chlorosticta 172
Choaspes 54
chromus 54, 447
Chrysalidocarpus 169
Chrysididæ 118
chrysippus, 29, 318, 411, 412, 415, 435, 438
Chrysocolaptes 89
chrysomallus 181, 442
chrysonotius 89
chrysophyllum 167
Chrysopogon 212

PAGE
chukor 6
Cienkowskia 170
ciliare 191, 197
ciliaris 193
ciliata 217, 219
ciliolatus 213
cilix 53
cimicina 218
cinerea 95, 142, 147
cinereus 137
cinnamomea 148
Cinnamomum 400
Cissus 165
Cirrhochroa 438
citratiis 205
citratus 65, 211
Citrus 114
clarkei 460
cleobis 49, 442
cleodus 366
*clitus 378
clytia 413, 446
cnejus 179, 441
*coalita 363
Coccystes 90
cochin-chinensis 194
Cocos 169, 486
cœlestis 45
Cœlogynis 422
cœrulescens 213
cœruleus 103
colaca 55, 56
Coladenia 58, 448
Coleoptera 393
Colias 444
Colomba 95, 99
columboides 334
Combretum 422
commersoni 169
communis 218, 219, 400
commutatus 67
compactus 216
comphora 400
concanus 442
concinnum 167
concinnus 208
concolor 62, 63, 88, 338
confertifolia 265
conjugatum 197, 199

PAGE
consimilis ... 437
contortus ... 199, 200, 201, 213
contra ... 91
cordatifolius ... 197
Cordyline ... 171
core ... 328, 412, 413, 415, 435, 436
coreoides ... 436
coriacea ... 272, 273
coromanda ... 143
coromandelianus ... 94, 99, 287
coromandelica ... 8, 93, 99
coromandelicus ... 15, 18
coromandus ... 95, 145, 147
coronata ... 89
coruscans ... 46, 365—367
coryllifolia ... 328
corymboa ... 193
corymbosus ... 193
Coturnix ... 8, 93, 99
Cotyle ... 88
coulteriana ... 400, 408
Coura ... 117
courtallumensis ... 193
Crastia ... 435
Crateropodidæ ... 61
crenatum ... 167
cretaceum ... 173
crinita ... 272, 273
crino ... 326, 327
Crinum ... 172
crispum ... 172
crispus ... 304
cristatus ... 1, 90, 92, 98, 124, 501
crocale ... 51, 320, 321, 444
Crocodilus ... 102, 108, 116, 126
Crocopus ... 96, 99
crocuta ... 457, 469
cruciatus ... 245
Cryptanthus ... 172
Cucifera ... 272
Cuculus ... 90
cuneatum ... 167
cunninghamii ... 172
Cupha ... 36, 437
Cupido ... 364
Cupitha ... 57
cuprea ... 170, 340
Cupressus ... 400
Curculigo ... 170

PAGE
Curculionidæ ... 263
Curetis ... 49, 181, 442
Curmeria ... 170
Cursorius ... 15, 16, 18
cuspidatus ... 193
cyane ... 36
Cyaniris ... 44, 177, 363, 440
Cyanophyllum ... 175
Cyclantheraceæ ... 169
cylindricum ... 190
cymbaria ... 217
Cymbidium ... 173, 422
Cynodon ... 480
Cynthia ... 438
Cypripedium ... 173, 422
Cypselus ... 89
Cyrestis ... 41, 358
Cyrtodeira ... 175
Cyrtomium ... 168
Cyrtosperma ... 170

Daboia ... 103
dactylon ... 480
Dalbergia ... 264
Dalchinia ... 446
dalhousianum ... 173
dan ... 58, 418
dana ... 46, 441
danaë ... 324, 325
Danainæ ... 411—413
Danais ... 27, 29, 318, 323, 328 411—413, 415, 435.
dara ... 57
daruka ... 354
dasahara ... 57, 391, 448
daurica ... 88
Davallia ... 168
davallioides ... 168
decidea ... 47, 179, 441
Decruris ... 105
deione ... 33
Delias ... 51, 323, 445
Demiegretta ... 145, 147
Dendrobium ... 173, 422, 423
Dendrochelidon ... 89
Dendrocygna ... 94, 99, 288, 289
dentata ... 49, 181
denticulatum ... 168
deodara ... 400, 407

PAGE
Deramas 361
derma 40
descombesi 51
Deudorix 377, 443
diadema 174
diaphanum 167
Dicæum 338
Dichoceros 333
dicruroides 90
Dicrurus 90
Dieffenbachia 170
digitatum 166, 170
dilectus 364
dilutus 89
Dimeria 189
dimissus 202
diocles 396
dioica 273
dioscorea 166
dipetala 174
Dipladenia 422
Dipsaceæ 408
dirtæa 40
discolor 165, 172
Discophora 36, 437
dissimilis 54, 328, 413, 446
dissoluta 354, 356
Dissura 142
distans 64, 211, 448
distorta 50
divergens 195, 196
dobroydense 167
Doleschallia 440
Dorema 400
dorippus 412
doson 446
Dracæna 171
Draco 101
dravidarum 446
Dromas 25
drona 443
druna 55
Drupadia 50
Drynaria 168
Dryobalanops 400
Dryophis 103, 420
dubia 22
duffii 168
dulce 124

PAGE
dulcis 124, 481
duryodana 36
dussumieri 10, 93, 99
duvancellii 96
Dypsis 169
dyrta 34

echerius 43
echinatum 192
echinatus 190, 192
Echis........103, 450, 452, 454—456, 503
Edolius 92
edule 157
edwardsi 11
edwardsii 93, 99
egrettoides 95
elaps 103
elata 422
elatum 198
elegans 103, 169, 196, 443
elengi 478
ellioti 117
elongatum 173
elpis ....46, 178, 365—367, 441
Elymnias 36, 437
Elymniinæ 437
emeria 61
emolus 45
emtallica 174
Engystomidæ 102
epicles 49
Epidendrum 173
epijarbas 443
Episcia 175
episcopa 142
epius 440
erecta 174, 182
Ergolis 36, 437
erichsonii 29
eriophorus 210
eriopoda 192
*eriphylæ 353
Erismatura 126
erithonius ....54, 114, 328—330, 446
erylus 50
erymanthis 36, 437
Erythra 138
Erythrina 274
rythronotus 90, 269

PAGE
erythrorhynchus 8, 338
eryx 876
Esacus 16, 19, 24
esculentum 168
ethion 47, 441
etolus 50, 442
Equus 457, 467
Eucharis 172
eucharis 323, 324, 444, 445
Euchloë 324
eudamippus 41
Eugenia 157
eulophia 174
eumolphus 373, 374
Euplœa 27, 29, 328, 412, 413, 415, 435
Euplœinæ 435
Eupoditis 93, 99
Eupodotis 11
Euripus 437
europa 27, 34, 436
Eurycles 172
eurymene 38
eurypylus 54
Euterpe 169
Euthalia 40, 350, 352, 353, 439
evelina 40, 439
Everes 45, 178, 441
exaltata 194
excavata 443
excelsa 256, 405
excisum 167
exclamationis 54, 446
extranea 231
exustus 92, 98

fabius 42, 440
fætidus 69, 71
Falcinellus 153
farinosa 168
farleyense 166
farri 56
farquhari 374
fasciatus 92, 98
fascicularis 202
Fasciolaria 263
fastigiatus 201
faveolatus 202
Felidæ 475, 499
Felis 457, 471
ferrea 374

PAGE
ferrierense 170
ferrugineus 93, 98, 239
Ferula 401
festivus 336
Ficus 157
fijiensis 168
filicifolia 166
filifera 88
filiformis 189
fistula 321, 485
Fittonia 175
flabelliformis 271, 272, 486
flammatra 233
flavala 62
flavicollis 91, 147
flavipennis 58
flaviventris 61, 62
flavocincta 379
flemingii 167
*fœtidus 205—206, 207
folus 58, 448
fotans 221
formosa 194
formosum 167, 173
foveolatus 201
fragrans 222
Francolinus 45, 93, 99
fraterna 444, 445
fraxinea 155, 168
freja 50
frivaldszkyi 374, 375
frondosa 107, 273
frontalis 224, 227—228, 229
fulgens 172, 360, 361
fulgida 175
Fulica 136
fuliginosa 299, 302
fulva 289, 50
furcans 168
furcifer 238
fuscescens 189
fuscicollis 305
fuscula 397
fuscus 89, 92

gæa 53, 323, 445
gaika 44, 177, 178
galanga 170
galba 448

PAGE
galbaniflua ... 401
galene ... 441
Gallicrex ... 124, 137
gallicus ... 16
Gallinago ... 303
gallinaria ... 303
Gallinula ... 138
Galloperdix ... 3, 4, 93, 93, 340
Gallus ... 2, 93, 98
gambrisius ... 39
gamra ... 44, 441
Gangara ... 447
gangeticus ... 102
garuda ... 40, 353, 354, 439
garzetta ... 95, 143, 144, 147
gaurus ... 96, 222
Gavæus ... 223, 228
gavæus ... 223
Gavialis ... 102
Gavœus ... 96
Gazella ... 96, 457—461
Gechonidæ ... 102
Gecinus ... 89
gelastes ... 293
Gelechia ... 238
geniculatum ... 197
genutia ... 29, 435
Geonoma ... 169
Gesnera ... 175
Gesneraciæ ... 175
Gerydus ... 43
gibbosa ... 194, 195
gidarba ... 67
giganteum ... 174
glaber ... 203, 450
glabrats ... 212
glabratus ... 212
Glareo ... 106
Glareola ... 17-19, 303
glaucippe ... 53, 444
glaucopsis ... 203
glomerata ... 157
gloriosum ... 170
gloxinia ... 175
glymnostachium ... 175
gnoma ... 51, 321, 322, 444
godartii ... 27, 32, 33
goensis ... 89
goisakius ... 340

PAGE
gola ... 57
gracilo ... 167
gracilis ... 190, 345
gracillimum ... 167
graminifolius ... 169
granatum ... 183
grandeloupense ... 124
grandiflora ... 174
grandifolium ... 270
grandis ... 485, 486
granella ... 239
granularis ... 196
Graucalus ... 90
grayi ... 143, 146, 147
gremius ... 57, 447
grewia ... 180
griseus ... 147, 149, 334
grunniens ... 225
Grus ... 129
grylls ... 212
gryllus ... 218
guava ... 183
gularies ... 145, 147
gularis ... 335
Gymnogramme ... 167
Gymnopogon ... 204
Gymnopteis ... 168

Habenaria ... 173, 174
hackelii ... 71, 207
hæmacephala ... 336, 337
halapense ... 214
halapensis ... 214, 215
Halcyon ... 89, 92, 333, 487
Halpe ... 57, 388, 447
hamada ... 44
Hamadoraceæ ... 172
hampsoni ... 46
hardwickii ... 62, 63, 89, 90
harina ... 51, 319
harisa ... 54
harpax ... 42
Hasora ... 446
hierax ... 42
Hierococcyx ... 90
Hieroglphus ... 238
hierta ... 37, 438
hierte ... 51

PAGE
Himantopus 132
Hiposcritia 53
Hipparchia 35
Hippeastrum 171
hippia 323
hippocla 354
hippoclus 41, 354
hippoides 444
hirtus 200
Hirundo 88
Hispa 241
hispidulum 167
Hebomoia 53, 444
hecabe 51, 318, 319, 443
hecabeoides 443
hector 329, 330, 414, 415, 446
Hedyscepe 169
helenore 48
helenus 54, 446
Heliconia 170
Heliothis 240
hellenore 374
Hemipus 339
Hemixos 62
hemprichi 292
Herodias 95, 143, 144, 147
Hesperia 59, 448
Hesperiidæ 54, 377, 396, 446
Hestia 435
heteroclita 217
heteroclitus 217
Heteropterus 393
Heterospathe 169
Heterpogon 199, 200, 201, 208
hewitsoni 43, 361
hodsoni 335
Hoffmannia 175
hohenacheri 189
holcus 214, 216, 217
Holcus 216
Hologamium 199
Homalomenas 170
hookeri 67
hopei 33
hordonia 37, 438
horsfieldi 339
horsfieldii 43
hottentota 269
Houbara 12

PAGE
Howea 169
howra 35
Hoya 422
huebneri 35, 436
*hugelii 69, 71
hügelii 205, 207
humilis 202
Huphina 53, 322, 324, 444
hyacinthina 173
Hyæna 457, 469, 471
Hyarotis 58, 448
hybrida 170
hydrocotylæfolia 174
Hydrophasianus 134
hylax 43
Hymenoptera 118
Hypanartia 354
hypatia 354, 356
Hyphœna 271, 272
hypoleucos 131
Hypolimnas 39, 411, 412, 415, 438
Hypolycæna 50
Hyposcritia 444
Hypotanidia 141
Hypoxideæ 170
hyppocla 354, 355
hyppoclus 354
hypselis 356—358
Hypsipetes 60—63
Hymenocallis 172
* hyrie 388

iapis 384
Ibis 151, 153
igneus 153
Ilerda 49
Iliades 446
imberbe 197
imberbis 457, 465
imna 440
Imperata 190
imperialis 30, 174
inachis 41
* inarime 391
inarina 439
incana 263
indica...51, 96, 117, 133, 270, 274, 324, 401, 409, 439

PAGE
indicum 270
indicus, 18, 22, 89, 91, 96, 133, 225, 228
indigofera 30
indra 50, 442
indrani 58, 448
Inga 124, 481
Inocotis 152, 153
insignis 201, 340, 390
insularis 365, 367
intermedia 95, 99, 143, 144, 147
intermedium 167
intermedius 67—69, 202, 203
interruptus 47
Iole 60
iphita 36, 438
Iraota 47, 180, 441
Irene 61
iriensis 435
irmæ 358
Ischæmum 196, 197, 199, 204
ischæmum 69, 202, 209
Iscilema 217
Isma 391
Ismene 54, 446
ismene 35, 39, 437
isocrates 183, 443
Isoteinon 57, 384
Issilema 218
iwarancusa 66, 211
Ixalus 450
Ixias 52, 324
Ixora 422

jaffra 442
jahnu 40
jaina 446
jama 396
jambolana 157
Jamides 46, 178, 367, 441
jarbas 50
jardinea 196
Jasminum 478
jasoda 361
javanica 106, 146, 147, 288, 417
javanicus 303
jehana 182, 442
jerdoni 62, 339
jhora 447
johnstonii 170

PAGE
joudera 9, 93, 96
jumbah 438
Juniperus 400
Junonia 28, 37, 438
junonia 436
Jurinea 400, 407
justina 436
jynteana 44

Kæmpferia 170
kalamita 495
kallaura 438
Kallima 4, 180, 439
kamarupa 38
kankena 365—367
Karatas 172
Keneuxia 449
Kerana 59
khamti 372
khasiana 39, 41, 58, 351, 352
khasianus 64
kinkurka 366
*kirata 344
kirkii 170, 463
klugii 29
kollari 435
kondulana 365, 366, 367, 368
kudu 457, 463
kumara 389
kundoo 319
kuntzeanus 68, 69

Labiatæ 452
lactea 17, 19, 106, 303
Lælia 172, 422
læta 51, 319, 443
lævigata 165
lahtora 90
laius 44, 176, 440
lalage 53, 444
Lampides 46, 178, 179, 364, 441
lanceolaria 265
lanceolatus 192
lancifolius 192
langi 34
laniger 66, 210, 211
lanigera 235
Lanius 90, 105, 269
lankana 443

PAGE
Laogona .... 354—357
lappa 400
larus 292, 293
Lastræa 168
Latania 169
latifolia 265
latimargus .... 364—367
latmanni 198
Laurus 400
laxiuscula 190
laxmi 382
laxum 199, 204, 218
laxus 215
lazulina 443
lea 53
Lebadea 39
Leda 35, 437
Leguminosæ 124, 264, 265, 274
Lehera 376
leitzii 171
lemonias 37, 438
Lemoniidæ 43
leo 457, 471
lepcha 33
lepida 437
lepidea 40, 439
Lepidoptera 393
leptopadix 169
Leptosia 443
Lepus 96
Lethe 27, 34, 436
Leucania 231
leucocephala 126
leucocephalus 149
leucocera 58, 59, 448
leucorodia 150
leucotes 61
libera 43
Libythea 43, 440
libythea 52, 443
lilacinus 39
Liliaceæ 171
limbatus 440
limborgii 41
Limenitis 39, 350
limetta 114
Limnas 435, 438
limniace 29, 323, 328, 435
Limninæ 435

PAGE
lindenium 170
linnæi 32
liomedon 446
Liphyra 176
liquidamber 400, 406
lithargyria 46
Lithocranius 460
Litobrochia 168
livens 361
lividus 67
Lobipluvia 23
Lobivanellus 18, 22, 133
Lobocla 383
Loesa .... 342—344
lohita 49, 442
Lohora 342
Lomariabagiba 168
longiflorum 172
longifolia 400, 401, 407
longiloba 170
longinus 178, 182, 442
longirostra 337
Lophopogon 201
Loriculus 269
lotenia 338
lowii 170
loxura 50, 182, 443
lubentina 40, 439
lucina 354, 355
luddemannii 167
lunulatum 167
lunulatus 4, 93, 98
lutescens 169
Lycæna 374
Lycænesthes 45
Lycænidæ 43, 175, 360, 440
lycænina 45
Lycastes 172
Lycastis 422
Lycopodium 168
Lygodium 166
Lygosoma 449
lysimon 44, 178

macei 90
machaon 328
*mackinnonii 346
macrocephala 400, 407
macrocercus 90

PAGE
macrophthalma 441
macrophyllum 166
macropoda 400
macrorhiza 270
maculata 171, 174, 435, 442
maculatus 96
macqueeni 12
maculosum 173
mæcenas 180, 441
mænalis 358, 359
mæsoides 447
mævius 57, 447
Magiria 241
magnifica 175
maha 177, 178
mahesa 40, 439
mahintha 54
mahratta 438
mahrattensis 89
Mainsuris 195
malabarica 23, 336, 399, 435
malabaricus 339
malaccensis 404
Malacocercus 91
malacophyllum 197
malacophyllus 198
malanoleucos 90
malaya 44
malayica 49
malcolmi 1
malsara 34
Mancipium 51
mandata 436
mandosa 436
mangala 55
mangaluricum 197
manicata 174
manillensis 304
Manisuris 196
Maranta 171
Marattia 155, 168
marginata 485, 486
marginatum 168
marianne 324
marmorata 166
maro 57, 447
maroccanus 245
marshalli 437
martabana 39

PAGE
martensii 168
Martinezia 169
martini 205, 211
Masdevallia 172, 422
masoni 58
Massaga 360, 361
masu 366
Matapa 54, 447
mathias 55, 447
Maxillaria 172
mecisteus 54
media 299
medica 114
meena 95, 99, 100
Megisba 44
*meiktila 57, 386
mekara 34
melachistos 90
melampus 50, 51, 183, 443
Melanitis 27, 35, 437
melannotus 94, 99
melanocephala 151
melanocephalus 153
melanocorne 244
melanogaster 153, 305, 306
melanogastra 19, 295, 303
melanoides 27, 29
melanolophus 340
melanostictus 495
melanotus 286
Melastomaceæ 175
Memecylon 157
Memina 117
Meminna 96
Menelaides 446
menaka 58
Meoschium 197
merione 36, 437
Merops 89, 269, 332, 426
mertensii 167
mesentina 322, 324, 444
mestor 53
miah 38
micans 193
Michelia 478
Micnopternus 335
Miconia 175
micranthus 69
Microperdix 8, 93, 99

PAGE
microphyllum 166
microphyllus 192
microptera 90
Micropus 61
microstachya 218
microsticta 33
microstictum 386
migratorius 245
Miltonia 422
Mimusops 478
mineus 33, 34, 344, 436
minima 337
minor 286, 291
minos 445
minuta 22, 149, 393
minutus 131
*miosticta 385
misippus 39, 411, 412, 438
mitiacens 207
mnasicles 34
Moduza 439
molle 192
mollicomus 208
mollis 192
Molpastes 60, 61
moluccana 400
molurus 424
monosperma 265
monostachyus 201
montanus 203, 213
monteithi 380
monticola 213
monticolus 89
moreli 172
Morina 400, 408
Moringa 219-221
*moringanus 219, 220
morpheus 393
Morphinæ 344
multifidum 167
multiflora 174
mundulum 167
munja 191
muricatus 67, 207
Muricidæ 263
Mutilla 118
Mutillidæ 118
Mycalesis 33, 341, 342, 436
mycrophyllus 192

PAGE
mycterizans 103, 424
Myiagra 91
myrrha 43, 440
*Myrtilus 341
*mystes 34, 342, 343

Nacaduba 45, 178, 441
Naia 193
nama 53, 444
namouna 36
nandina 39
* nar 349
nara 47
naradoides 180, 441
Narathura 374
nardoides 212
nardus 64, 65, 205, 211
narendra 444
Narmada 436
narooa 417
naso 457, 458, 461
nazo 461
*neæra 379
neelgherriensis 436
Nemeobiinæ 440
neo-guinense 167
Neope 34
neophron 43
Neopithecops 43, 440
Neotragus 457, 462, 463
nepalensis 204
Nepheronea 53, 323, 444, 445
Nephrodium 168
Nephrolepis 168
Neptis 27, 37, 349, 356, 438
nervosum 199
Netrocoryne 383
Nettapus 94, 99
Nettopus 287
Nichitonia 318
nictitatans 428, 429
nidus 168
nigra 90
nigriceps 90
nigricollis 96, 292
nigrolimbata 57
nilagiriensis 444
nilgiriensis 435
niphe 439

PAGE
Nissanga 436
nivalis 359, 360
nivea 359, 360
nobile 173
Noctues 231
nomius 54, 330, 416
Notocrypta 58, 379, 382, 448
notubilis 265
nucifera 486
nudum 193
nudus 193
nutans 200
Nychitona 51
Nyctanthes 479
Nycticorax 147, 149
Nyctiornis 333
Nymphalidæ 29, 341, 356, 413, 435
Nymphalinæ 346, 413, 437
nyseus 45, 441

obliquivalvis 198
obscurus 448
obsoleta 447
obtusus 210
oceia 55
ochrocephalus 61
Ochropleura 233
Ocimum 478
oculus 436
Ocyceros 334
Odontoglossum 172, 422
Odontoptilum 448
odorata 207
odoratum 173
odoratus 68, 69, 203—205
odorus 222
Œcophilla 124
Œdicnemus 297
officanarum 190
officinale 106
officinalis 400, 405
olbia 74
olivascens 59, 396
olivieri 210
Oncidium 172
onocrotalus 303
onpape 54
ophiana 39
Ophiophagus 103
Ophiopogon 172

PAGE
Ophiurus 193
Oreotragus 457, 467
orientale 168, 416
orientalis 17, 18, 400, 406
Oriolus 61, 319
orithyia 37, 438
ornatum 170
ornithopoda 189
Ornithoptera 53, 445
Orpheides 446
orseis 50
Orsotriæna 436
Ortygornis 7, 93, 99
Oryx 457, 466, 467
oscitans 151
osias 365
othona 50
otis 44, 178, 440
Otocompsa 61, 62
Ovis 187, 278

pachnodes 211
pachyarthus 202
Pachytylus 245
Pademma 435
Padraona 57, 417
pæcilorhyncha 290
palawana 333
Paleornis 334
Pallinea 198
palustris 102, 108, 117, 126
pammon 329, 446
Pancratium 172
Pandaneæ 169
Pandanus 169
pandava 28, 46, 179, 441
paniculata 265
paniculigera 172
pandiyana 446
panope 328, 413
Papilio, 53, 114, 325, 354, 413, 414, 445
Papilionidæ 51, 318, 413, 443
Papilioninæ 53, 325, 445
papillosus 152, 153
  radiseus 90
paradisi 91
Paradoxurus 428, 429
paraganesa 369
Paragerydus 43

PAGE
Parantica 435
Parantirrhæa 437
Parata 54, 447
pardina 171
paris 54
Parnara 55, 384, 388, 447
Parra 133
Parthenos 39, 439
parvata 352
parviflorus 450, 456, 503
parysatis 36
pasithoë 51
Passer 91
Passiflora 166
patchouli 450
Pathysa 445
paulina 53, 322, 444
Pavo 1, 92, 98
pediada 360, 362
Pelecanus 303, 304
Pellæa 168
Pellionia 175
pelzelni 462
pembertoni 29
pentadactylon 166
Peperomia 175
Perdicula 7, 8, 99
peregrinum 242, 416
peregrinus 90
perforata 193
perforatus 193
perfossus 202
Pericrocotus 90
Perilla 451
Peristeria 422
perius 40, 439
perse 443
perseus 33, 436
persica 456
pertusus 67, 69, 202, 209
peruvianum 166
petiolare 198, 199
petiolaris 198, 199
petiolatus 199
petosiris 50
Petraceros 96
Phacochœrus 457, 468
Phænicopterus 285, 286
phænicura 138

PAGE
Phajus 174
Phalacrocorax 304, 305
Phalænopsis 174
phalantha 36, 438
pharyge 361
pheretia 362
pheretria 362
phidippus 437
philarchus 439
philatus 365, 368
philetus 368
philippensis 89
philippinus 303, 304
Philodendron 166, 170
philomela 35
phisara 58
Phlangium 171
phœnicopterus 96, 99
Phœnix 169
phryne 53, 322, 324, 444
Phyllornis 339
picatus 339
picrardi 173
pictus 5, 96, 93
Picus 89
pieridoides 377
Pierinæ 51, 318, 443
pillosum 199
pilosus 199
Pinanga 169
pingasa 445
Pinus 256, 400, 401, 407
Piperaceæ 175
Pithecolobium 124
Pithecops 43
Pitta 91
Placena 263
placenta 263
placida 44
plagiosa 37, 438
Platalea 150
platanifolia 174
Platanthera 173
plectranthoides 450
Pleopeltis 168
Plesioneura 380, 382, 384
Pleuroplitis 193
Pleurotus 219
plinius 47, 179

PAGE

Plotus 153, 305, 306
plumbea 193
plumosa 168, 169
plumosus 171
Podiceps 291, 292, 501
podophylla 168
pœkilorhyncha 94, 99
Pogostemon 450, 456, 503
Poinciana 71
Poivrea 422
poli 278
polibete 440
poliocephalus 135
Pollinia 192, 204
polymnestor 325, 327, 446
Polyommatus 47, 79, 441
Polyphasia 90
Polypodium 168
polystachius 201
polytes 53, 329, 330, 414, 415
Pomatorhinus 339
pondiceriana 7, 90, 93, 99
pondicerianus 102, 339
Poritia 43, 360—362
porosus 102, 116, 117
Porphyrio 135
Portax 96
portii 170
Porzana 139, 140
Pothos 166
potina 360, 361
pratincola 17, 18
Pratincola 337
pratti 375
pravara 40
precatorius 274
Precis 36, 438
princeps 171
procris 39, 439
prorepens 197
prostata 217
prostrata 218
proximus 211
prunosa 440
psaroides 62
pseudelpis 365
pseudevanthe 444
pseudomæsa 447
Psidium 183

PAGE

Psilostachys 189
Psolos 396, 397
Psoralea 328
Pteris 168
Pterocles 92, 98
pterygosperma 219-221
* pugnans 384
pugnax 93, 99
pulcherrima 71
pulligo 396, 397
pumilus 202
punctatus 202, 203
puncticollis 336
punica 183
pura 46, 366
purendra 391
purpurascens 450
purpurea 95, 143, 147
purpureo-sericeum 215
purpuricaulis 452
purreea 52, 57
puspa 44, 177, 440
pygmæa 33
pygmæus 305
Pyrameis 439
pyramus 51
pyranthe 51, 321, 322, 444
pyrene 52, 324
Python 424

quadricornis 96
quartianus 193
quercetorum 47, 442
Quercus 263
quinticolor 332

rahria 41
rama 48, 372, 440
ramosissimum 199
Rana 103
Ranidæ 102
ransonnetii 394, 448
Rapala 50, 183, 376, 443
Raphidophora 166
Rathinda 443
ravi 58
rectivitta 377
recurva 400
recurvata 170

PAGE
recurvirostris 16, 19, 24, 303
* refulgens 376
regalis 171
regina 33
relata 438
remba 444
Reptilia 100
restricta 58, 448
rex 174
rhadamanthus 53
Rhaphis 213
Rhinopalpa 41
rhizophorus 192
Rhodonessa 290
Rhopalostylis 169
Rhynchæa 130
Rhynchophorus 239
Rhynchops 19, 106, 302
richardsiana 174
risorius 95, 99, 100
robusta 241, 400
roezlii 165
rogenhoferi 29
Rohana 438
rohria 34
rosimon 47, 179, 441
rostrata 219
rotang 77
rotata 172
Rottbællia 193, 195
Rottbœllia 193, 194, 196
rotunda 170
roxburghi 174
royleanus 212
rubella 168, 174, 319, 443
Rubiaceæ 175
Rucervus 96
rugosum 196, 197
Ruminantia 184
runeka 33
rupicola 169
Rusa 96
Russella 221
russellii 103
rustica 88

saccharatum 217
saccharatus 217
Saccarum 76, 190

PAGE
Saccolabium 174, 422
saitis 436
Salatura 435
saloma 438
salsala 59, 447
saltatrix 457, 467
Salvadora 456
sanctum 478
*Sancus 395-397
sankara 350
Santalum 400
sara 76
Sarangesa 57, 391, 418
Sarcidiornis 286
sari 52
Sarkidiornis 94, 99
sarpedon 54
sasivarna 55
Satarupa 58
*sati 391
Satsuma 374
sattanga 37, 38
satwa 58
Satyrinæ 436
saundersi 297, 301
saundersii 172, 174
Saussurea 400
savara 35
scabrum 172
scandens 166, 209, 217
scaposa 170
sceptra 174
Schænanthum 211
schænanthus 65, 66
Schismatoglottis 170
schistacea 50, 183, 443
Schizandra 166
Schizocasia 170
Schizoneura 235
schœnanthus 211
schreiberi 440
Scincidæ 102
Scindapsus 166
Scitamineæ 170
scolopax 25, 297
scopas 393
scrofa 278
secundum 173
sedeva 350—352

PAGE
Seena 106
seena 19, 294, 303
segetum 233
Selaginella 165, 168
selenophora 40, 439
selloum 170
semamora 56
semidecumbens 190
semisagitatum 197, 199
semperflorens 174
senegalensis 95, 99, 100
septentrionis 29, 435
serrata 400, 401
serratus 208
serrulatus 213
sesquipedale 173
shalgrama 55
Shorea 400, 409
signata 380
silhetensis 48
Simiskina 360
sinensis 88, 148
sinha 36
* sinis 357
Sinningia 175
Sinthusa 443
sissoo 265
smaragdina 124
smyrnensis 333, 487
sœmmerringii 457, 460
soma 39
somalicus 457, 467
sondaicus 223, 224, 226, 227, 229, 230.
Sonerila 422
sonnerati 2
sonneratii 93, 98
Sorghum 214, 215
sorghum 215, 216
spadiceus 3, 93, 98, 340
Spalgis 440
Spathiphyllum 170
speciosa 172
specioses 90
speciosum 166
spectabilis 169, 172
speckii 462
Sphærostema 166
spiloptera 36

PAGE
spinosa 264, 265
Spizixus 60
Spodiopogon 192, 197—199
spontaneum 190
sprengelii 213
spretus 245
Stanhopea 172
Stauronotus 245
Stegosia 194
Sterna 19, 106, 293, 294—303
Steropes 393
stocksii 265
strabo 46, 179, 441
Strepsiceros 457, 463, 465
striata 141, 457, 471
striatus 63
strictus 202
striolatus 89
Strobilanthus 338
Strymon 376
Sturnopastor 91
Styrax 400, 405
squarosus 207
squarrosus 67
Suastus 57, 447
suaveis 450
* subcæruleum 449
subdita 32, 365, 366, 368
subfasciatus 395—397, 447
subrepens 203
subtestaceus 57
succinctum 244, 245
suffusa 43, 233, 440
sugriva 443
suidas 365
sulcatum 199
sultaneus 89
sultianus 463
sumatrensis 358
superbiens 423
sura 448
suratensis 95, 99, 100
surculosa 171
Surendra 47, 442
surga 443
Surniculus 90
Sus 96, 278
susannæ 173
swinhoei 438, 443

PAGE
syama 49
sykesii 90
sylvicola 338
Symbrenthia 41, 354, 356
symethus 43
sympathetica 265
Symphædra 40
Sypheotides 13, 94, 99
syrichthus 58

taburau 1
Tagetes 182
Tagiades 58, 392, 393, 396, 397, 448
taigoor 9
Tajuria 50, 178, 435, 442
talboti 195
Talicada 45, 441
talura 400, 409
Tanaëcia 352
tankervillæ 174
Tantalus 149
Tapena 58, 382, 384
taprobana 437
Taractrocera 57, 447
Taraxacum 106
Taraka 44
Taramix 273
Tarucus 46, 179
taurus 225
taylorii 394
Tchitrea 91
Tecoma 166
Telchinia 437
Telicota 57, 447
tenellum 197
tenellus 209
tenera 189
tenerum 166
Tephrodornis 90, 338
teredon 446
teres 174
Terias 51, 318, 443
terricolor 91
tetraphyllum 167
thais 438
thebaica 272, 273
Thecla 374—376
Thelepogon 196
theophrastus 46, 179

PAGE
thetis 181
thibautiana 170
Thunia 174
Thrinax 169
Thriponax 335
thwaitesi 58, 383
thyodamas 41
thyrsis 447
Ticherra 50
tiga 38
tigrina 103
timoleon 47, 441
timorense 198
Tinea 239
Tirumala 435
Tockus 334
todara 436
toona 56, 447
torra 143
torquilla 89
torulosa 400
tounguva 49
Trachycomus 61
trapeziforme 166
travancorica 434, 437
*travancoricus 450
tremula 217
tridentata 201
tridentatus 201
trifurcata 182
trifasciata 166
trigonocephalus 101
Trimeresurus 101
Tringoides 131
trinii 213
*tripura 392, 393
tristachius 192
tristachya 192, 204
tristis 91, 105
triticens 201
trivictis 213
trochilus 44, 177
trogon 374
Tubeca 169
Turnix 9, 10, 93, 99
Turtur 95, 99, 100
typicus 193
ubaldus 44, 45
Udaspes 58, 448

PAGE

ulunda 396, 397
uncinata 165
undularis 36
unguis 124
Ungulata 184
Urticaceæ 175
utilis 169

vacans 444
Vanda 174, 422
Vanessa 41, 354, 356, 439
Vanilla 422
Varanidæ 102
Varanus 421
Variegatum 171, 215
varius 90
varmona 38, 438
vasuki 41
Vateria 401, 409
veitchii 173
venata 52
verecunda 173
veneris 167
ventricosa 272
veratrifolia 173
vernalis 269
verrucosum 166
versicolor 65
verticillatus 213
vestita 173
Vetiveria 207
victoriæ 117, 167
Vilaite 82
villatus 105
villosa 218
villosum 197
villosus 69, 197
vindhya 34
vinosa 170
violaceum 170
violæ 437
Vipera 103
Virachola 183, 443
viraja 38, 438
Virapa 436
virens 439

PAGE

viridis 89, 269, 426
viridissima 374
visala 436
Vitis 165
vittatus 447
vogeli 168
Volvocivera 90
vulcanus 182, 442
vulgare 214, 216
vulgaris 4, 93, 99, 117, 118, 495

walleri 457, 459, 460
wallichii 174
wardi 439
wardii 444
watsonii 57, 388
wedelliana 169
wightii 193, 215, 217, 218
wilisianum 167
willdenowii 165, 168

Xantholæma 336
Xanthosoma 170
Xenorhynchus 141
xiphia 51, 318, 443
xiphiones 351, 352

Yphthima 35, 436
ypthimoides 436
Yungipicus 89
Yunx 89

zalmora 43, 440
Zarona 361
zebra 59
zebrina 171, 172
zelmira 53
zelonica 337
Zeltus 50, 442
Zesius 181, 442
Zetides 446
zeylanicum 172
Zinaspa 50
Zipætis 436
zitenius 36
Zizera 44, 177, 440

LIST OF CONTRIBUTORS.

VOLUME VI.

PAGE

AITKEN, E. H; *The Migrations of Birds.* 268

——— *Protection of Larvæ* ... 489

ANONYMOUS; *The Temper of Animals.* 849

J. A. B.; *The Butterflies of the Central Provinces*..........175, 318

BAKER, E. C. S.; *The Genus* Chloropsis 59

BARNES, Lieut. H. E., F. Z. S.; *Nesting in Western India.* (With three Plates) 1, 129, 285

BARTON, E. L.; *A Panther eating a Panther* 274

BLANFORD, W.T., F.R.S., F.Z.S.; *On the Gaur* (Bos gaurus) *and its allies*.. 222

BOULENGER, G. A.; *Description of a new species of Lizard obtained by Mr. H. L. Ferguson in Travancore, Southern India* 449

———; *Description of a new species of Frog obtained by Mr. H. S. Ferguson in Travancore, Southern India* 450

BULKLEY, H.; *The Crested Grebe breeding in India* 501

CARSTENSEN, G.; *Curious instance of abnormal inflorescence of* Cæsalpinia (Poinciana) pulcherrima. (With a Plate.) 71

———; *Landscape Gardening in Native States* 72

———; Pithecolobium unguis ... 124

———; *Bombay Ferneries* 153

———; *Doum Palms in India*...... 271

———; *A Gall on* Tamarix dioica 273

———; *A variety of* Butea frondosa 273

COTES, E. C.; *Agricultural Entomology* 230

———; *The Locust of North-Western India* (Acridium peregrinum). (With a Plate.) 242

PAGE

COTES, E. C; *The Natural Enemies of the Locust* 416

DALGADO, D. G.; Dalbergia spinosa... 264

DAVIDSON, J., Bo. C. S.; *Notes on Nidification in Kanara* 331

DAVIES, C. A. W.; *A Man-eating Panther*.. 108

DYMOCK, W., Brigade-Surgeon, Retired; Alocasia macrorhiza 270

———; *Substances used as Incense in the East*.......... 399

———; *On the value of the plant Pangala* (Pogostemon parviflorus) *in cases of bites by the Phursa Snake* (Echis carinata) 450

FERGUSON, H. S.; *Distribution of Indian Crocodiles* 116

———; *Victoria Crown Pigeons breeding in confinement*........... .. 117

———; *Indian Otters* 117

———; *The breeding of Snakes* ... 420

———; *A fasting Snake* 424

———; *A List of the Butterflies of Travancore* 432

GAYE, W.; *Snipe Shooting in the neighbourhood of Secunderabad* ... 418

GILBERT, REGINALD; *A Man-eating Bear* 276

GRIFFITH, FRANK; *Bombay Ferneries.* 421

HALY, A; *A new method of preserving and mounting Zoological specimens*.. 489

HART, MRS. W.E; *Protective Mimicry.* 410

HEWETT, H. M.; *Has the Bakri a keen sense of smell?* 497

HEXTON, W. S.; *The protection of Game in Sind* 487

HORE, W. S.; Lieut.-Colonel; *Taming a Heron*................................ 417

INVERARITY, J. D.; *Notes on the Mammalia of Somali Land.* (With six Plates.) 457

PAGE

JACKSON, H. ST. JOHN; *Bombay Ferneries* ... 423

——— ——— ———; *Landscape Gardening in Native States* ... 478

JAMES, H. E. M.; *The protection of Game in Sind* ... 487

SUTTON—JONES, Capt. G.; *Harpooning Crocodiles* ... 107

TUAN KECHIL; *Tigers in Sumatra* ... 496

KIRTIKAR, Surgeon-Major K.R., I.M.D., *Notes on a rare Fungus found growing on the Drumstick tree.* (With a Plate.) ... 219

LE'VEILLE', F. H.; *Concerning the presence of the* Taraxacum officinale *in the Nilgherries* ... 106

LIGHT, Captain R.; *The temerity of Rats* ... 264

LISBOA, Dr. J. C., F. Z. S.; *Bombay Grasses* ... 189

LISBOA, MRS. J. C.; *A list of the Odoriferous Grasses of India, with a description of a new species of* Andropogon ... 64

MACKENZIE, Colonel KENNETH; *Memory* versus *Reason in Cats* ... 419

MORRIS, A. W., F. Z. S.; *On abnormal horns of the Indian Antelope, with some remarks on their probable causes.* (With a Plate.) ... 184

NICE'VILLE, LIONEL DE, F. E. S., C.M.Z.S.; *On new and little known Butterflies from the Indo-Malayan region.* (With two Plates.) ... 341

——— ——— ———; *Branching Palms and Tree-Ferns.* ... 486

OMMANNEY, H. T., Bo. C. S.; *A variety of* Butea frondosa ... 107

PAGE

PHIPSON, H. M.; *The breeding of Snakes* ... 420

PLAYFAIR, H. A.; *Memorandum on Wolf-killing operations in* 1891 ... 266

RICHARDSON, W. ST. JOHN, Captain; *Price of Tigers'-skins, &c., in England* ... 278

———; *Geographical Distribution of the Pin-tail Snipe* ... 488

SAGE, Major C. A. R.; *Leaf-Weevils* ... 263

SINCLAIR, W. F., Bo. C. S; *Shingle and Shells from the beach at Umbargaum* ... 262

TAYLOR, JAMES; *Description of a new species of Palm-Civet* (Paradoxurus) *found in Orissa.* (With a Plate)... 429

TEGETMEIR, W. B; *The poison of the Toad* ... 494

WARD, Colonel, K. C. E., C. I. E; *The destruction of life by Wolves in the Hoshangabad and Narsinghpur Districts* ... 265

WASEY, GEORGE K; *How the Monitor or Ghorapad* (Varanus bengalensis) *defends itself* ... 421

WATSON, E. Y.; *Notes on a collection of Butterflies made in the Chin-Lushai Expedition of* 1889-90 ... 26

WOODROW, G. MARSHALL; *The Cultivation of Oranges, Lemons, and Figs in India* ... 111

———; *Note on* Cassia grandis, *Linn., and* C. marginata, *Roxb*... 485

WRIGHT, FRED.; *The sagacity of the Langoor* ... 424

WROUGHTON, ROBERT C.; *Our* Hymenoptera ... 118

LIST OF PLATES.

VOLUME VI.

To face page

Eggs of Indian Birds 1

Inflorescence of *Cæsalpinia (Poinciana) pulcherrima*.................. 71

Eggs of Indian Birds 129

Abnormal horns of the Indian Antelope (*Antelope bezoartica*) 184

Agaricus (Pleurotus) moringanus 219

Acridium pereginum, with its transformations......................... 242

Eggs of Indian Birds 285

Indo-Malayan Butterflies, Pl. F.. 341

Indo-Malayan Butterflies, Pl. G. 341

Paradoxurus nictitans (Taylor) 429

Gazella walleri 459

Sœmmerring's Gazelle (*Gazella sœmmerringii*) 460

Gazella nazo 461

The Koodoo (*Strepsiceros kudu*)....................................... 463

The Lesser Koodoo (*Strepsiceros imberbis*) 465

The Klipspringer *(Oreotragus saltarix)* 467

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CONTENTS OF THIS NUMBER.

PAGE

LIST OF MEMBERS i

NESTING IN WESTERN INDIA. (*Continued*) (*With a Plate.*) By Lieut. H. E. Barnes, F.Z.S. 1

NOTES ON A COLLECTION OF BUTTERFLIES MADE IN THE CHIN LUSHAI EXPEDITION OF 1889-90. By E. Y. Watson 26

THE GENUS *Chloropsis*. By E. C. S. Baker 59

A LIST OF THE ODORIFEROUS GRASSES OF INDIA, WITH A DESCRIPTION OF A NEW SPECIES OF ANDROPOGON. By Mrs. J. C. Lisboa 64

CURIOUS INSTANCE OF ABNORMAL INFLOROSCENCE OF CÆSALPINIA (POINCIANA) PULCHERRIMA (*With a Plate*)........................ 71

LANDSCAPE GARDENING IN NATIVE STATES. By G. Carstensen, Superintendent, Victoria Gardens, Bombay 72

LIST OF BIRDS' EGGS IN THE SOCIETY'S COLLECTION ON 1ST JANUARY, 1891 83

THE PRESERVATION OF INSECTIVOROUS BIRDS, BIRDS OF PLUMAGE, AND GAME IN THE CENTRAL PROVINCES 87

REVIEWS OF NEW BOOKS—

"The Reptilia and Batrachia of India" 100

"Hume's Indian Oology" 104

MISCELLANEOUS NOTES—

1.—Concerning the presence of the *Taraxacum officinale* in the Nilgherries 106

2.—A Variety of *Butea Frondosa* 107

3.—Harpooning Crocodiles.. 107

4.—A Man-eating Panther 108

5.—The Cultivation of Oranges, Lemons, and Figs in India 111

6.—Distribution of Indian Crocodiles 116

7.—Victoria Crown Pigeons breeding in Confinement.............. 117

8.—Indian Otters.. 117

9.—Our Hymenoptera.. 118

PROCEEDINGS.. 118

The Proposed Introduction of Game into the neighbourhood of Bombay.. 119

Pithecolobium unguis 124

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CONTENTS OF THIS NUMBER.

PAGE

NESTING IN WESTERN INDIA. (*Continued.*) By Lieut. H. E. Barnes, F.Z.S. *(With a Plate.)* ... 129

BOMBAY FERNERIES. By G. H. Carstensen, Superintendent, Municipal Gardens ... 153

THE BUTTERFLIES OF THE CENTRAL PROVINCES. Part IV. By J. A. B. ... 175

ON ABNORMAL HORNS OF THE INDIAN ANTELOPE, WITH SOME REMARKS ON THEIR PROBABLE CAUSES. *(With a Plate.)* By A. W. Morris, F.Z.S. ... 184

BOMBAY GRASSES. (Part IV.) By Dr. J. C. Lisboa, F.L.S. ... 189

NOTES ON A RARE FUNGUS FOUND GROWING ON THE DRUMSTICK TREE. By Surgeon-Major K. R. Kirtikar, I.M.D. *(With a Plate)* ... 219

ON THE GAUR (BOS GAURUS) AND ITS ALLIES. By W. T. Blanford, F.R.S., F.Z.S. ... 222

AGRICULTURAL ENTOMOLOGY. By E. C. Cotes ... 230

THE LOCUST OF NORTH-WESTERN INDIA. By E. C. Cotes. *(With a Plate)* ... 242

MISCELLANEOUS NOTES—

1.—Shingle and Shells from the Beach at Umbargaum ... 262
2.—Leaf Weevils ... 263
3.—The Temerity of Rats ... 264
4.—Dalbergia spinosa ... 264
5.—The Destruction of Life by Wolves in the Hoshangabad and Narsinghpur Districts ... 265
6.—The Migrations of Birds ... 268
7.—Alocasia macrorhiza ... 270
8.—Doum Palms in India ... 271
9.—A Gall on Tamarix dioica ... 273
10.—A Variety of Butea frondosa ... 273
11 —A Panther Eating a Panther ... 274
12.—A Man-killing Bear ... 276
13.—Price of Tigers' Skins in England, &c. ... 278

PROCEEDINGS ... 278

The Protection of Wild Birds and Animals ... 281

STATEMENTS OF ACCOUNTS FROM 1ST JANUARY, 1890, TO 31ST DECEMBER, 1890 ... 283

Bombay Natural History Society.

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CONTENTS OF THIS NUMBER.

PAGE

NESTING IN WESTERN INDIA. (*Continued.*) By Lieut. H. E. Barnes, F.Z.S. *(With a Plate.)* ... 285

THE BUTTERFLIES OF THE CENTRAL PROVINCES. Part V. By J. A. B. ... 318

NOTES ON NIDIFICATION IN KANARA. By J. Davidson, Bo. C.S. ... 331

ON NEW AND LITTLE-KNOWN BUTTERFLIES FROM THE INDO-MALAYAN REGION. By Lionel de Nicéville, F.E.S., C.M.Z.S., &c. *(With Plates F. and G.)* ... 341

SUBSTANCES USED AS INCENSE IN THE EAST. By W. Dymock, Brigade-Surgeon, Retired ... 399

PROTECTIVE MIMICRY. By Mrs. W. E. Hart ... 410

MISCELLANEOUS NOTES—

1.—The Natural Enemies of the Locust ... 416
2.—Taming a Heron ... 417
3.—Snipe Shooting in the Neighbourhood of Secunderabad ... 418
4.—Memory *Versus* Reason in Cats ... 419
5.—The Breeding of Snakes ... 420
6.—How the Monitor or Ghorapad (*Varanus bengalensis*) defends Itself ... 421
7.—Bombay Ferneries ... 421
8.—A Fasting Snake ... 424
9.—The Sagacity of the Langoor ... 424

PROCEEDINGS ... 425

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CONTENTS OF THIS NUMBER.

PAGE

Description of a New Species of Palm-Civet (*Paradoxurus*) found in Orissa. By James Taylor. (*With a Plate.*) 429

A List of the Butterflies of Travancore. By H. S. Ferguson, F.L.S. 432

Description of a New Species of Lizard obtained by Mr. H. S. Ferguson in Travancore, Southern India. By G. A. Boulenger 449

Description of a New Species of Frog obtained by Mr. H. S. Ferguson in Travancore, Southern India. By G. A. Boulenger 450

On the Value of the Plant Pangala (*Pogostemon parviflorus*) in Cases of Bites by the Phursa Snake (*Echis carinata*). By Brigade-Surgeon W. Dymock (Retired) 450

Notes on the Mammalia of Somali Land. By J. D. Inverarity. (*With six Plates*) 457

Landscape Gardening in Native States. By H. St. John Jackson 478

Miscellaneous Notes—

1.—Note on *Cassia grandis*, Linn., and *C. marginata*, Roxb. 485

2.—Branching Palms and Tree-Ferns 486

3.—The Protection of Game in Sind 487

4.—Geographical Distribution of the Pin-Tail Snipe 488

5.—Protection of Larvæ 489

6.—A new Method of Preserving and Mounting Zoological Specimens 489

7.—The Poison of the Toad 494

8.—Tigers in Sumatra 496

9.—Has the Bakri a Keen Sense of Smell? 497

10.—The Temper of Animals 498

11.—The Crested Grebe breeding in India 501

Proceedings 501

List of Books in the Society's Library 504

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INDEX

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